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Editorial:

Atomic Energy — Credit and Debit, 1946 . . . .

As the Bulletin of the Atomic Scientists enters its second year, the Manhattan District has ceased to exist and a civilian commission has taken over all atomic developments in the United States. On the same New Year's day, the UN Atomic Energy Commission has turned over to the Security Council its first report, embodying the essentials of the Lilienthal-Baruch control plan.

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Much has been achieved since those days in June 1945 when groups of scientists on the Manhattan District first realized the urgent need to enlighten the American people about the dangers which the impending advent of the atomic bomb represented to the security of our own country. After the existence of the bomb was revealed by the destruction of Hiroshima, organizations of scientists dedicated to this enlightenment, sprang up, first in the several "sites" of the Manhattan District, then in many other centers of learning and research.

The legislative fight for the civilian control of atomic energy first brought these groups into the public eye. But in the long run, the enlightenment of the people, was and remains, even more important than the "education of politicians." Again and again, scientists met with whatever group was ready to listen to them, and repeated the same chain of arguments: "Atomic energy is a fact of nature; as such, it cannot be kept secret; the 'secrets of the atomic bomb' are only a set of engineering procedures which other nations are certain to develop within a few years. There is no defense; no amount of preparedness can prevent the destruction of American cities in an atomic war; therefore, our only security lies in an effective international control of atomic energy to prevent atomic bombs from being made anywhere in the world."

At first, these ideas seemed visionary, and their carriers, suspicious radicals. But the unassailable logic has, in the course of a year, conquered the National Administration, then the governments of England and Canada, and finally the United Nations. Conservative statesmen, industralists and Army men, including General Groves, have become protagonists of international control. It was written into the McMahon Bill, passed unanimously by the Senate; into the Truman-Attlee-King declaration; into the Moscow statement of the Big Three; into the disarmament resolution passed unanimously by 54 nations in the UN Assembly; and most explicitly, into the Report of the UN Atomic Energy Commission to the Security Council. This Report was adopted by 10 votes to 0—with U.S.S.R. and Poland abstaining not because of opposition to its principles, but because of their unwillingness to support a recommendation for the advance relinquishment of veto in the case of sanctions against violators of the controls.

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Thus, looking back, one is tempted to feel satisfied. And yet, when we turn towards the future, how ominous it still is, and how precarious all the progress achieved! In the domestic field, the carrying out of the enlightened principles of the McMahon Bill is by no means certain. The naive concept that security can be safeguarded by clamping the lid of secrecy on unreliable scientists, is still being propagated, with the hope of finding more response in the new, Republican Congress. Outside the atomic field, the tide of militarization has swept over two-thirds of American science, and those who believe that without free science, as without free education, there can be no free America (and even no strong America) face an uphill fight for a National Research Foundation. The trend towards militarization of science—which is only a forerunner of general regimentation of the country—should not be blamed on wilful groups or personalities. It is the inevitable consequence of the armaments race. In the face of military danger, politicians and masses alike turn to seek salvation in more and more military control, regimentation and secrecy. Therefore, the fight for international understanding is also the only effective fight for domestic freedom.

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The American plan is now before the Security Council. The recent changes in Soviet attitude towards international control and inspection raise hopes that these fundamental features of the plan will be confirmed by the Council. The chances of salvation from atomic war rest with the decision, which must be close at hand. But even if the Council approves the plan, the realization of this first community enterprise of mankind will face innumerable difficulties. Ignorance, ambition, economic selfishness and political suspicion, will make a thousand small and large controversies look insoluble. The question of the "veto", so violently injected into the discussions of the UN Commission, is one of them. Already those who want to destroy the Baruch plan, have chosen the veto controversy as their weapon. The group, which is likely to be the last to accept

(Continued on last page)

President Conant Supports Nat'l. Science Foundation

The award of the Westinghouse prize for best science reporting in the newspapers is surely not unrelated to the whole problem of the interrelation of science and society of which we hear so much in these postwar days. One of the problems which this free society has before it is to evolve procedures for supporting research and education through public funds, and at the same time provide for the maximum of independence and local control of our institutions. This is a point which might well be stressed in more than one story of the weekly news. The methods by which science is advanced are as newsworthy as the advances in science; all of you will want to interpret wisely and sympathetically, therefore, public opinion in regard to the relation of the Federal government to our universities and research institutes.

During the war our colleges and universities came in much closer contact with the Federal government than ever before. Large sums of money were spent on research and development in many universities by means of contracts with the Army, the Navy, and the Office of Scientific Research and Development, a wartime Federal agency. No one can deny the importance of the work done by the universities for the Federal government during the war years. An account of some of it has been presented recently in a book by President Baxter of Williams College, entitled "Scientists Against Time."

Today, fifteen months after V-J Day we still find the colleges and universities having many dealings with the Federal government. Thanks to the so-called G. I. Bill, large numbers of veterans are receiving college and university education with substantial subsidies from the Federal government. We are in effect operating our colleges with a Federal scholarship program for those who served in the armed forces of the country. But that is another story. On the research side many institutions are operating research contracts with the Army and the Navy though on a non-secret basis. The leaders of the armed forces have been farsighted in supporting such basic research, but this is presumably not the final answer to channeling Federal funds.

It is natural for those concerned with the future of advanced education to wonder what lies ahead after the period of demobilization is over. Is Federal money to continue to flow to our institutions of advanced learning? If so, how can we avoid the development of a centralized control of higher education which everyone admits would be most unfortunate. In looking into the future, it seems important for all of us to think as clearly as possible about the relation of our educational institutions to the Federal government. This is no simple problem, the answer to which can be summed up in a headline or a few clichés. Rather, it is one of those intricate problems in the organization of modern society that needs careful analysis and thoughtful consideration.

In a very challenging document published by the government more than a year ago, entitled "Science, the Endless Frontier," there was set forth a strong argument for the establishment of a new Federal agency, the National Science Foundation. This agency was to be created by Congress and supplied with funds for the purpose of supporting basic scientific research in the universities and colleges of the land. A bill embodying the essential features of this report passed the Senate at the last session—it was known as Senate Bill 1850—but time was too short to permit of its final consideration on the floor of the House. **I very much hope that this bill, or one closely related to it, will be passed by the coming Congress.** It seems to me that it is a matter of great importance to the country that this should be done. With the record of the war behind us, one need hardly argue for the importance of basic scientific research as an integral part of a national defense program, and alas, in the type of world we now live it is necessary to consider the problems of national defense. Until such time comes when we can drastically reduce our Army and our Navy and our Air Force, until such time comes that we are living in a world where problems of national security are no longer of major importance, the government clearly must support the development of basic scientific research and the education of scientific workers if for no other reason than because of the importance of these activities in terms of the total military picture. There is, of course, another important reason, or rather two, for the Federal support of scientific research, namely, the fact that the development of modern industry on the one hand and modern medicine on the other are tied closely to the development of modern science.

When this National Science Foundation is created, as I hope it will be, it will be in a position to make grants of money to the universities for the support of the very expensive basic research in such sciences as physics, chemistry, biology, geology, psychology. Such grants would be in no way connected with direct military projects. Indeed, in time of peace I think it highly inadvisable for universities which are dedicated to free investigation to undertake the type of investigation they did during the war for patriotic reasons, namely, secret or confidential work. All secret research in days of peace should be done in government laboratories, arsenals, and proving grounds.

If the National Science Foundation is properly set up and properly managed, I have no fear myself that there will be any deleterious effects to the universities even if they receive very large sums of money for the support of scientific research by this route from the Federal government.

Obviously, the president of the American Association for the Advancement of Science must be careful in any remarks that he may make lest he appear to be speaking on behalf of the vast membership. I think what I have said up to now, however, represents a point of view from which relatively few would dissent. Indeed, I suggest that the members of the press here assembled keep their ears open during the coming days of the convention, not so much for divergent views on minor matters, but for the chorus of unanimity among scientists for the need of a National Science Foundation, both for basic research in universities and for a scholarship program through Federal grants.

Remarks by President James B. Conant at the Science Writers Award Luncheon, at Boston on Friday, December 27, 1946.

National Science Legislation....

Part 2. The Case for the Social Sciences . . . . . *Talcott Parsons*

In this part, I intend to present the case for inclusion of support of research in the social sciences in any federal program for support of scientific research in general. There are two principal aspects of the question: first whether social science should be supported at all, and second whether it should be included in the same legislation and in the same National Science Foundation as the natural sciences. I should like to answer both questions strongly in the affirmative.

This seems to me to be the occasion for speaking primarily in terms of principle rather than of the most suitable tactics for the political realization of the desirable goal. I should like merely to record my conviction that no considerations on the level of political expediency seem to me to be cogent enough to necessitate the explicit exclusion of support of social science research from the functions of a National Foundation. A very modest opportunity to prove their place is all that the social sciences should need or request, but there is every reason both in principle and on practical grounds why the door should be opened to them in a modest way. There seems to be no need for a special division of social science in the Foundation, but the function of divisions —both of basic science and in applied areas such as public health, public welfare or national defense—should be so defined as to call for the mobilization of all the nation's scientific resources in whatever fields, which can contribute to the purposes of the legislation. But let us return to the question of principle.

THE FUNDAMENTAL REASONS FOR THE SUPPORT OF THE SOCIAL SCIENCES

There are, I think, three fundamental inter-related aspects of the broadest question. In the first place, the urgency of the practical needs for rational control of social processes is so great and so obvious as scarcely to need discussion. Most scientists, as well as other intelligent citizens, would agree that the great problems of our time are not those of the control of nature but of the stability and adequacy of the social order. It is not the urgency of social problems; it is the question of whether the scientific method is capable of making a significant contribution to their solution which needs discussion.

Secondly, science is not a mere isolated technical tool in modern western society. Its roots penetrate to the deepest levels of our cultural and moral motivations. The understanding of nature in the broadest sense of the total world we live in, including ourselves and our place in it, and the control of natural processes in terms of rational understanding, are values which have been realized in the western world to a higher degree than anywhere else in history. These values do not apply only to one segregated aspect of our world and life experience—to nature in the narrower sense. In the nature of these values and of their place in society they cannot be so segregated. Our civilization as a whole is deeply committed to the great adventure of rational understanding of man and society, as well as of the physical and biological world. Science as a body of highly technical knowledge and procedures is the most highly developed expression of this fundamental system of attitudes and values of our civilization. The fact that it has developed earlier and farther in such fields as physics, chemistry and biology, is more a matter of the inherent difficulties and obstacles in the field of human behavior, than it is of our fundamental interests and values. But the same fundamental motives which make many of our finest minds devote their lives to research in physical science are equally applicable to the social field. The challenge in the latter is even greater because of the greater difficulties, and in certain respects the greater importance to human life of the consequences.

Thirdly, this fundamental unity of value and attitude toward rational understanding of our world is expressed on the actual level of scientific endeavor. In fact, all science is a fundamental unity. It simply is not possible to draw sharp, clear-cut lines between the natural and the social sciences. The unity is not only a unity of fundamental method and outlook; it is a unity of actual shading off of knowledge and its application, of problems and their solutions. There have been in the history of scientific thought and its philosophical borderlines many attempts to extend the specific thought patterns and conclusions of physical and biological science to the social field. These attempts have for the most part failed. It is always dangerous to reach conclusions without careful specific investigation of the facts of the particular field in question. Nevertheless, the justified insistence on the autonomy of the social sciences in this sense: that they have their own empirical subject matter which can only be understood through direct study and not through transfer of conclusions from other fields —this should not obscure the equally important fact that this autonomy is relative; that man is an organism, that his behavior is in fact partly, though only partly, understandable in biological terms; and that the senses in which it is biological and those in which it is psychological and sociological are so closely interdependent that it is not in the interest of science to attempt to set up watertight compartments between these different aspects. Each side needs the contributions of the others, and many of the most important problems fall across the line.

There is a further aspect of the unity of the social and the physical sciences in their practical relations to society. We are all familiar with the fact that we live in a technological age. It would be absolutely impossible to operate the complicated technology of modern industry or medicine, for example, without the services of scientifically trained personnel. Furthermore, problems are continually arising which can only be solved by the techniques of scientific research with the personnel and equipment necessary for their use. Over against this, it is a common idea that the common man is his own social scientist; that any ordinary intelligent person is qualified to understand the operation of social processes. Even so far as the current situation is concerned, this is very far from the truth. To a very substantial and rapidly increasing degree, the actual functioning of our social order is dependent on a social technology which is in fact applied social science. Technically trained personnel are playing a larger and larger part—for instance, in the administrative process, in the adjustment of industrial relations, in the field of communications, in the control functions of the economy as through the central banking system, in the control of foreign trade, and various such fields. Great as it is, the difference between the two aspects is one of degree—not of kind. Furthermore, we live in the kind of society which, it becomes increasingly evident, can only be effectively operated by more efficient applied social science, not by less, or even by letting the present situation stagnate.

The first part of the article by Prof. Parsons, Chairman of the Department of Social Relations at Harvard University, appeared in the BULLETIN Vol. 2, No. 7-8.

THE CONDITIONS FOR GROWTH OF THE SOCIAL SCIENCES

It follows from the fundamental unity of natural and social science that their basic needs are equally of the same fundamental order. There seems to be an American tendency in both fields to emphasize the practical and the applied to the detriment of the fundamental development of scientific theory. Adequate support for and motivation of work in the fields of fundamental theory is perhaps the greatest need of science, natural or social. This type of work is the subtlest and most difficult, and cannot be called into being by financial grants alone. It is, however, almost certainly responsive to a general climate of high valuation of its achievements. A society which is afraid of public support of social science is by that token less likely to attract the type of intellectual ability into these fields on which the most fundamental theoretical development of the field will be dependent.

But the so-called basic science, with special reference to theory, cannot fruitfully develop in a vacuum; it must be in continual and fruitful interaction with empirical work on many different levels and in many different fields. It may well be that the most important support of basic theoretical work should not come from public sources, but should be the primary responsibility of the universities. This point of view is not, however, incompatible with the view that the large-scale support of empirical work, shading into many applied fields, should be carried on from public sources. This will give the atmosphere of activity and the large-scale resources for empirical testing and verification of theory which are essential to the further development of theory itself.

Without question, the social sciences have been behind the natural in many of their most fundamental aspects of development. One of the most conspicuous symptoms of this has been the extent to which, until recently, social science has been essentially a library discipline. The last generation has seen a notable change in this situation. To a rapidly increasing extent, social scientists have emerged from the library and taken up the direct empirical study of the phenomena about them. The fact that the social sciences have reached this stage of development has created a need for facilities which have the same function as laboratory equipment in the natural sciences. In order, however, to study the larger-scale social phenomena in a significant way, it has become necessary to have facilities even more elaborate and expensive, though of a different character, from those used in the other fields.

One important recent development of this kind may be cited. Much social generalization is overwhelmingly dependent on adequate statistical information. Most statistical information available to the social sciences in the past has been a by-product of other interests, such as those of the census for purposes of determining the voting population, of taxation policies and control policies in the economic field. The significance of the available material for scientific purposes has been sharply limited by the conditions of, and the non-scientific interests dictating, its collection. Recent developments of sampling technique, however, have made it possible to generalize about large and complex populations from relatively small samples. This in turn has, for almost the first time, made it feasible to collect statistical data for the specific purpose of testing scientific hypotheses as such. Though sampling has enormously reduced the cost of securing adequate data, nevertheless it remains an exceedingly expensive operation and requires support on a very substantial scale. The possible fruitfulness of this type of work in the social fields increases the need for financial support to a notable degree.

It further follows from the view of the unity of all science which has been stated earlier, that the social, as well as the natural, sciences should, if they are genuine and solid disciplines, produce practical applications of great significance to social welfare. Is there in fact substantial evidence that this is the case? There undoubtedly is, though it must be freely admitted that the results produced are as yet by no means so dramatic nor on an over-all basis so substantial as those in the natural sciences. The war, however, produced a rapid acceleration of significant work of practical usefulness, and a few examples of what has been done may help to make the point.

WARTIME APPLICATIONS OF THE SOCIAL SCIENCES

The fact that during the war there was no social science equivalent of the O.S.R.D. has meant that the work done has been much more scattered, and has on the whole not been widely brought to public attention. The first example which may be cited is one which, though it had important wartime applications, has been by no means confined to usefulness in that connection. It is that of the analysis of economic processes in terms of income flow, and the understanding of fluctuations in the state of economic activity as a result of disturbances of this flow. In the period of the great depression, this type of analysis opened the door to intervention in the economy through the supplying of additional purchasing power from government sources. Conversely, in the war and early postwar period, it has provided the theoretical basis of price control policy, without which we would unquestionably have had a much more severe inflationary spiral than has in fact developed. It should be noted that the scientific basis of suggestions for public policy in this field is not only a matter of theoretical analysis, associated particularly with the name of the late Lord Keynes, but also of elaborate statistical analysis of the relevant quantitative factors in the economy, the most significant work being that done in the National Bureau of Economic Research by Dr. Kuznets and his associates.

The opinion of the most qualified economists is that the fundamental barriers to stabilization of the economy do not lie so much in lack of knowledge of the essential economic processes involved but in the difficulty of implementing these through the available political machinery, which again is a human and social problem.

A quite different field of practical application of social science analysis is that of the understanding of the significance of social and cultural differences in adjusting the relationships of peoples whose background is different in this respect. One of the most significant enterprises in this field was the study of Japanese military morale, conducted by Dr. Alexander Leighton, Dr. Clyde Kluckholm and their colleagues in the Office of War Information, in cooperation with the armed services. These studies formed a basis, in the latter period of the war in the Pacific, for a psychological warfare policy, which had begun before the end to have important practical results, and which certainly could not have been arrived at on the basis of common sense. They also unquestionably had a good deal to do with the policies toward working out the surrender of Japanese forces without incurring the serious last ditch resistance so many feared.

Still another important and large-scale example of applied social research was the work of the research branch of the Information and Education Division of the War Department. Their extensive studies of attitudes in the army, using the techniques of statistical sampling and attitude and opinion study, played an important part in solving many practical problems of army administration. Two examples may be cited. On the one hand, this work helped greatly in understanding what measures would be effective and necessary in getting troops in the Southwest Pacific to accept the rather drastic measures which were technically necessary to con-

trol malaria. Without this control, it is very doubtful whether American military operations in that area could have succeeded, and securing it was, given the state of medical knowledge, a social not a medical problem. Secondly, it was primarily the studies which this group made of attitudes toward priority of discharge which were responsible for the major policies of the point system. It was these studies which convinced the General Staff that for morale reasons it was essential to give combat veterans priority in discharge, even though it had seemed to be a great military advantage to utilize European veterans in the Pacific war after conclusion of the war in Europe.

Another most important field in which psychological and social science was of practical use during the war, was in selection of personnel for highly specialized functions. Outstanding examples of successful work in this field were the aviation personnel selection studies of the Army Air Corps, and the selection procedure which was adopted in the latter period of the war by the Office of Strategic Services for the selection of personnel for dangerous missions. Many more examples could be cited, but these are sufficient to demonstrate that competently planned and directed social research is in fact capable of producing results of first-rate significance to many practical fields of great importance.

In comparison with the tremendous needs, the results may appear very modest, but this is not the most important fact. The essential fact is that given competent direction, that is, selection of the best people who are now available to do the work, and given sufficient resources in the way of personnel and organization, the social sciences can deliver, in certain fields, results which are of direct and fundamental practical importance. Performance of this character is not as yet typical of the social sciences, but it has appeared in a sufficient number of instances and sufficiently widely distributed over a number of fields so that there can no longer be any doubt of the authenticity of claims that social science is established as a genuine scientific discipline which can produce results far beyond any from commonsense sources.

McCLOY PREDICTS SUPER ATOMIC BOMBS WITHIN DECADE

The following extract is from an address delivered by John J. McCloy, former Assistant Secretary of War, during the annual convention of the National Association of Life Underwriters:

"I have indicated that it is becoming tiresome to hear about the bomb. But if the fact of the bomb at Hiroshima, Nagasaki and Bikini is not sufficiently convincing, further potentialities of the bomb should be sufficient to startle the most sluggish-minded among us. The bomb dropped at Nagasaki, which was an 'improvement' over the Hiroshima bomb (and it was substantially the same type bombs which were exploded at Bikini), was a very crude affair judged by the testimony of the men who made it. It is very crude compared to what they believe is possible by way of purely mechanical improvement. By devices which are comparable to those employed in improving the Nagasaki bomb over the Hiroshima bomb it is certainly possible substantially to increase its destructive power. It is certainly possible to increase the quantity of the fissionable material in the bomb. We talk today of the bomb in terms of the equivalent of twenty thousand tons of TNT. From first-hand information given to me by the scientists whose prophecies were uncannily accurate during the course of the war, there can be little doubt that within the next ten years, to be conservative, bombs of the power equivalent of one hundred thousand to two hundred and fifty thousand tons of TNT can be made, something over ten times more powerful than the bomb dropped on Hiroshima. And if we can move to the other end of the periodic table and utilize hydrogen in the generation of energy, we would have a bomb somewhere around one thousand times as powerful as the Nagasaki bomb. I have been told by scientists who are not mere theorists but who actually planned and made the bomb which was exploded in New Mexico that, given the same intensive effort which was employed during the war toward the production of that bomb, we were within two years time at the close of the war of producing a bomb of the hydrogen-helium type, i.e., a bomb of approximately one thousand times of the power of the present bombs."

THE PROMISE AND DANGER OF FEDERAL SUPPORT

The essential case for support of the social sciences does not rest on their previous record or their present state; it rests on their potentialities. The relevance of the previous record and the present state is in its demonstration that a point has been reached where the potentialities are not merely a matter of hopeful speculation, but of demonstrated actuality. We can be as certain as we can be of anything in this world that, if genuinely able talent and adequate resources are invested in the further development of the social sciences, they have potentialities of development which are far beyond anything which has been concretely imagined.

This is, of course, not in the least to say that there are no dangers in the way. From many points of view, the dangers are serious and, if they are not carefully guarded against, might well prove to be crippling. Too rapid and indiscriminate increase in resources available to these fields might prove more of a handicap than a help. Avoiding embroilment in political issues is certainly more difficult than in the case of the natural sciences. The task of developing the potentialities of social science is thus by no means an easy one, but its very difficulty is part of the challenge. A certain modesty, indeed humility, should be central to the whole scientific point of view, and is certainly shared by the best of social scientists as well as by those of other fields. But with all due humility, many will feel that there is no other path to improvement in our social situation, to the mitigation of conflict, to reducing the danger of war, to the increase of prosperity and welfare, than through the application of careful empirical observation and careful theoretical analysis to the solution of social problems. The scientific point of view is probably the greatest hope of modern society and, if this hope is to be realized, it cannot be confined to one sector of the total field of science.

Disarmament Debate in the UN General Assembly

During December, the subject of atomic energy control was shifted, in a series of dramatic developments, from the General Assembly to the Atomic Energy Commission, and thence to the Security Council, where it now rests.

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The discussion of atomic energy in the General Assembly grew out of the debate on disarmament. In the Bulletin issue of November 1, we reprinted parts of the speech given by Mr. Molotov on October 29. By a strange twist, this speech, with its wildly exaggerated attacks on the American plan of international atomic energy control and on Mr. Baruch personally, also seems to mark the beginning of the end of the previously intransigeant Soviet opposition to this very plan.

Molotov's speech of October 29 culminated in the following proposals:

"1. In the interests of consolidating international peace and security and in conformity with the purposes and principles of the United Nations Organization the General Assembly considers a general reduction of armaments necessary.

"2. The implementation of the decision on the reduction of armaments should include as a primary objective the banning of the manufacture and use of atomic energy for military purposes."

The subsequent debate — first in the General Assembly and then in its Committee No. 1 (Political and Security Questions)—has revolved partly around the disarmament resolution itself and partly around successive proposals for a census of troops and armaments. First it was to be the census of troops stationed in the territories of other member nations of the UN; then it was to include the troops stationed in former enemy countries; then also troops at home; and finally, the Soviet delegate proposed that it should include the census of offensive armaments—a proposal which was interpreted by some as an attempt to force to disclosure by the United States of the number of atomic bombs in her possession.

After much rhetoric, the census controversy collapsed. Probably, the military intelligence everywhere has a pretty good idea of the number of divisions other nations maintain at home or abroad, and a rough idea of the extent of their major armaments. Enough information has been made public to permit shrewd guesses even as to the approximate quantity of atomic bombs produced in this country.

The disarmament resolution, was debated in Committee 1 from November 28 till December 13.

As the discussion opened on November 28, Mr. Molotov recalled the Soviet proposal for an international convention to prohibit the production and use of atomic weapons, and stressed that these indispensable measures has not yet been adopted. He asserted that none doubted the correctness of the agreement of 20 years ago to outlaw poison gas and bacteriological warfare; the refusal to arrive at a convention on the outlawing of atomic weapons contradicted the hopes of the peoples of the world.

All would agree, Mr. Molotov said, with Stalin's recent statement that a strict international control of atomic energy was necessary. Agreement must be reached on the concrete aspects and details of this problem, including the prohibition of the atomic weapon.

Mr. Molotov then introduced an additional proposal for armaments control. This envisaged the establishment within the framework of the Security Council of special organs of inspection:

"(a) A commission for the control of the execution of the decision regarding the reduction of armaments;

"(b) A commission for the control of the execution of the decision regarding the prohibition of the use of atomic energy for military purposes."

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Thus came the first break in the line strictly maintained by U.S.S.R. in the UN Atomic Energy Commission. The use of the word "inspection" in Molotov's proposal signified that the U.S.S.R. finally agreed to discuss the international control of atomic weapons on a realistic basis, instead of insisting on a mere atomic disarmament convention between sovereign nations. True, the resolution of the General Assembly on January 24, 1946, which established the Atomic Energy Commission, had called for "effective safeguards by way of inspection and other means to protect complying states against the hazards of violation and evasion"—but the attitude of the Soviet delegation in the Commission has been to ignore this part of the Commission's terms of reference and to stress national sovereignty as a bar to international inspection.

Alexandre Parodi (France) at that time, Chairman of the Atomic Energy Commission, emphasized that the general discussion of disarmament should not complicate or interfere with the work of that Commission. The Committee should take account of the more advanced stage of the Commission's work.

The Canadian and Australian delegates, **Mr. Wilgress** and **Mr. Hasluck**, introduced amendments to the Soviet resolution intended to incorporate into it an express reference to the terms of reference of the Atomic Energy Commission. Since the activities in the domain of atomic energy leading to peaceful and destructive ends are so intimately interrelated as to be almost inseparable, the amendments stated that the control of atomic energy to ensure its use only for peaceful purposes, the elimination of atomic weapons from national armaments, and the provision of effective safeguards to protect complying states must be accomplished through a single international treaty.

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The French, Australian and Canadian statements were indicative of the alarm felt by many that the Soviet general disarmament proposal was intended to lead—or might in practice lead—away from the realistic approach to the atomic energy control plans, as discussed in the Atomic Energy Commission, particularly in its Scientific and Technical group, replacing it by the type of diplomatic wrangling familiar from previous disarmament talks.

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Sir Hartley Shawcross (United Kingdom) expressed pleasure that the U.S.S.R. no longer opposed an international system of control.

The United Kingdom, which had been compelled for the first time in its history to introduce conscription in time of peace, was anxious to secure an early and large measure of armament limitation, but was not prepared for any unilateral disarmament.

Disarmament and collective security must go hand in hand. There must be adequate control to assure that states were actually disarming and carrying out limitation agreements.

The United Kingdom was ready to open all doors to an international system of control for collective security and the inspection, control and limitation of armaments not subject to any "veto." Only with such a system of control could the U.S.S.R. resolution be lifted out of the realm of propaganda and become a real hope for the world.

At the meeting of the Committee on November 29, **Senator Tom Connally** (United States) agreed on the importance

of establishing an effective system of reduction and control of armaments. Proposals had been submitted he said, to the Atomic Energy Commission by the representatives of the U.S.S.R. and United States. The U.S.S.R. proposal was an agreement to outlaw atomic weapons, prohibit their manufacture and destroy the present stocks of atomic bombs. This was also part of the United States proposal which provided that when an adequate system for control had been agreed on and put into effective operation, with punishments set up for violation of the rules, manufacture of bombs should stop, existing bombs should be disposed of, and the Authority should be in possession of full information on the production of atomic energy.

Senator Connally hoped that in the light of recent statements by Stalin and Molotov on the necessity of strict international control, including inspection, the Atomic Energy Commission could end its stalemate of recent months. It was not enough to outlaw the atomic bomb; freedom to violate pledges could not remain in the hands of individual nations. The fundamental principle of effective international control and safeguards, including inspection to protect complying states against violations and evasions, should apply to the regulation of all weapons.

Sir Hartley Shawcross wondered what the relation was between the two commissions suggested by the U.S.S.R. and the Atomic Energy Commission.

He also asked whether the U.S.S.R. contemplated that the control machinery to be established should be subject to the authority of the Security Council to the extent that the unanimity of the Council would be essential to its operation.

Vyshinsky (U.S.S.R.) stated that the additional U.S.S.R. proposal specified an international control with "special organs of inspection." This control system was to be established within the framework of the Security Council. As a consequence, the conclusion must be drawn that this system would be subject to all the Charter provisions affecting the consideration by the Security Council of the questions in its competence.

Sir Hartley Shawcross declared that he was still uncertain, despite Mr. Vyshinsky's answer, of the exact relation between the control commission involved in the U.S.S.R. proposal and the Atomic Energy Commission. The question was whether that resolution proposed to alter the present status of the Atomic Energy Commission, established by the General Assembly and at present unaffected by a Security Council "veto," by placing it under the Security Council whose "veto" would govern its activities.

In his opinion the confidence of the world might be undermined on the realization that a control system could be obstructed by the operation of the unanimity rule.

His Government wished for control of the atomic weapon and any other devices for indiscriminate mass destruction such as rocket bombs or bacteriological warfare, and also for a system of inspection and control, because a nation planning or making these weapons might exercise a "veto" against the inspection process. Any system which is to be more than a pious hope, he said, must enable an international body to enter any country without fear of "veto" or prohibition of inspection. He thought the Canadian and Australian amendments were important because of their specific, concrete, unambiguous nature. The wording of the USSR resolution, on the other hand, was so ambiguous that he could not be certain its adoption would not fetter the Member states with a "veto."

In reply, **Mr. Vyshinsky** stated that his Government stood by the principle of unanimity established by Article 27 of the Charter, which provides for the method of voting in the Security Council; further, his Government did not mean to renounce that principle.

At the meeting of the Committee on November 30, **Mr. Parodi** remarked that it was now quite clear that the control of armaments was inseparable from the control of the production and use, even the peaceful use, of atomic energy.

General agreement seemed to have been reached that disarmament was not possible without a parallel organization of security. Security meant—first and foremost—control, and his delegation noted with satisfaction that international control had now been generally accepted.

It was not opportune now to raise the question of the "veto." Naturally control would not merit being called control if a state which was to be controlled could elude all control measures of its own will.

Mr. Wilgress (Canada) asked what the words, "within the framework of the Security Council," in the U.S.S.R. proposal meant. Was it to be understood that before an inspection was carried out by a commission in the territory of any one of the permanent members of the Security Council, that member would be able to exercise his "veto" to prevent such inspection? Was it to be understood that if such inspections were not prevented by the exercise of the "veto," any action resulting from a report by the inspecting commission would be subject to "veto" action by one of the permanent members?

If that was what was meant, then the powers of the inspection commission proposed in the U.S.S.R. resolution would be quite insufficient. The commission proposed by Canada would have freedom of access to inspect anywhere in any state in order to satisfy itself and the whole world that no breach of the disarmament treaty was taking place.

Sir Hartley Shawcross pointed out that the Soviet proposal quite frankly and clearly placed the whole responsibility for disarmament—not merely for formulating plans, but for bringing disarmament about, for acting as the main executive body for control, for inspection—in the hands of the Security Council. There were then to be two commissions whose position was wholly undefined except that they were to be the organs of the Security Council.

That was not good enough for the United Kingdom. Was it good enough for the smaller nations which might not even have seats on the Security Council at all?

J. V. Wilson (New Zealand) declared that the organs of control must be autonomous within their own sphere and free to proceed to measures of inspection, to the publication of their findings and to the execution of any other measures within their competence. Their decisions must not be subject in any way to review or confirmation by the Security Council. Their decisions should be taken by a majority vote.

Senator Connally explained the United States position as evidenced in a draft proposal that had been submitted by his delegation.

The first paragraph of this resolution gave recognition to the necessity of an early general regulation and reduction of armanents and proposed a recommendation to the Security Council to give prompt consideration to working out the practical measures, according to their priority.

The second paragraph continued that early establishment of international control of atomic energy and other modern technological discoveries to ensure their use only for peaceful purposes was essential to the general regulation and reduction of armaments. Accordingly, the proposal would recommend that the Security Council give first consideration to the report which the Atomic Energy Commis-

sion will make to the Security Council before December 31, 1946, and facilitate the progress of the work of that Commission.

The third paragraph stated that the provision of practical and effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions is essential. Therefore it is proposed to recommend to the Security Council to give prompt consideration to the working out of proposals to provide such practical and effective safeguards in connection with the control of atomic energy and other limitation or regulation of armaments.

Senator Connally explained that it was was not intended that the Security Council would have jurisdiction or authority itself to do the inspecting and regulating. It was meant merely that it should draw up a plan and submit it. This plan, if adopted, would thereafter be operative.

Further, the United States would not agree to any plan whatever in connection with atomic energy unless it provided that the operating agency would have wide and rigid and adequate inspection powers to see that all nation observe the regulations and the inspections "without a veto."

The United States, said Senator Connally, does not believe in any partial system; it wants a comprehensive system of disarmament. The system of inspection and control was absolutely fundamental. There must be adequate international control, and it must not be subject to being blocked and destroyed by any state or group of states through the "veto."

Vyshinsky's attitude on November 30 and December 2 left the impression that the U.S.S.R., while agreeing, somewhat reluctantly, to discuss control and inspection as part of the disarmament problem, was not prepared to concede the degree of independence of the control organs which would permit them to operate independently of the "unanimity rule" affecting the proceedings in the Security Council. This impression was changed by Mr. Molotov's speech two days later. Mr. Molotov (U.S.S.R.) said on December 4 that the U.S.S.R. would consider the adoption of the following three important points as an essential first step toward disarmament:

1. The time had arrived to proceed with a general reduction of armaments.

2. The General Assembly must express its opinion on the question of the prohibition of atomic weapons in view of the alarm these caused in the world.

3. The General Assembly must decide that it is necessary to establish a reliable system of international control over the reduction of armaments and the prohibition of atomic weapons which would allow for inspection in all countries.

Of the several resolutions on disarmament before the Committee, that of the United States was closest to the resolution of the U.S.S.R. Mr. Molotov expressed willingness to accept the United States draft as a basis for further discussion, and submitted amendments which embodied his Government's ideas.

The first amendment concerned the second paragraph of the United States resolution, which he proposed to redraft so that the General Assembly would urge the expeditious fulfilment by the Atomic Energy Commission of its terms of reference, and recommend that the Security Council should expedite consideration of the report which the Atomic Energy Commission will make to the Security Council before December 31, 1946, and also that the Security Council should expedite consideration of a draft convention for the prohibition of atomic weapons.

Mr. Molotov proposed to add a third paragraph to establish within the framework of the Security Council, special organs of inspection. For this purpose there would be formed a commission for the control of the execution of the decision regarding the reduction of armaments, and a commission for the control of the execution of the decision regarding the prohibition of the use of atomic energy for military purposes.

The United States resolution, continued Mr. Molotov, raised the question whether a decision on disarmament should be made through the medium of an international treaty or should take the form of a decision of the Security Council. The U.S.S.R. delegation believed that an international agreement would involve delay, and it therefore recommended that a resolution should be taken by the Security Council.

To dispel any misunderstanding about the application of the unanimity rule, Mr. Molotov stated that the Security Council would take a decision on the reduction of armaments, including the prohibition of atomic weapons and the establishment of control commissions, only when there existed unanimity among the permanent members of the Security Council.

After the Security Council had taken its decision, the established control commissions would work in conformity with the rules specified by the Security Council. The rule of unanimity in the Security Council had nothing to do with the work of the control commissions. Therefore, he stated, it was incorrect to say that a permanent member with its "veto" could prevent the implementation of the control system. Any attempt to prevent an inspection would constitute a violation of the Security Council's decision.

The second and most important concession of the U.S.S.R.—the consent that the control and inspection commissions, although established "within the framework" of the Security Council, should not be subject to the "unanimity rule," opened the way for final drafting of a generally acceptable disarmament resolution.

* * *

The main residual subject of controversy—as far as the control of atomic and general disarmament is concerned—was whether the control bodies should derive their authority from the Security Council (as desired by USSR) or from a convention or treaty ratified by the member nations (as suggested in the U.S. draft resolution). The argument was resolved, in the final text of the resolution, by stating that the control bodies are to be established according to a plan drafted by the Security Council and operate "within the framework of the Security Council," but that they shall derive their powers and status from the convention or conventions under which they are established.

British, American and French representatives repeatedly stressed in the debate that the work and responsibilities of the Atomic Energy Commission should in no way be abridged, and a paragraph emphasizing this point was inserted into the resolution against an initial opposition of the USSR. The specific Soviet proposals for the creation of two Security Council Commissions—one for atomic and one for general disarmament — were dropped, leaving to the Security Council a free hand in formulating the structure of the control organs to be established by convention.

Principles Governing the General Regulation and Reduction of Armaments

The full text of the disarmament resolution, passed unanimously by the General Assembly on December 14th, follows:

1. In pursuance of Article II of the Charter and with a view to strengthening international peace and security in conformity with the Purposes and Principles of the United Nations,

THE GENERAL ASSEMBLY,

RECOGNIZES the necessity of an early general regulation and reduction of armaments and armed forces.

2. Accordingly,

THE GENERAL ASSEMBLY,

RECOMMENDS that the Security Council give prompt consideration to formulating the practical measures, according to their priority, which are essential to provide for the general regulation and reduction of armaments and armed forces and to assure that such regulation and reduction of armaments and armed forces will be generally observed by all participants and not unilaterally by only some of the participants. The plans formulated by the Security Council shall be submitted by the Secretary General to the Members of the United Nations for consideration at a special session of the General Assembly. The treaties or conventions approved by the General Assembly shall be submitted to the signatory States for ratification in accordance with Article 26 of the Charter.

3. As an essential step towards the urgent objective of prohibiting and eliminating from national armaments atomic and all other major weapons adaptable now and in the future to mass destruction, and the early establishment of international control of atomic energy and other modern scientific discoveries and technical developments to ensure their use only for peaceful purposes,

THE GENERAL ASSEMBLY,

URGES the expeditious fulfilment by the Atomic Energy Commission of its terms of reference as set forth in Section 5 of the General Assembly Resolution of 24 January 1946.

4. In order to ensure that the general prohibition, regulation and reduction of armaments are directed towards the major weapons of modern warfare and not merely towards the minor weapons,

THE GENERAL ASSEMBLY,

RECOMMENDS that the Security Council expedite consideration of the reports which the Atomic Energy Commission will make to the Security Council and that it facilitate the work of that Commission, and also that the Security Council expedite consideration of a draft convention or conventions for the creation of an international system of control and inspection, these conventions to include the prohibition of atomic and all other major weapons adaptable now and in the future to mass destruction and the control of atomic energy to the extent necessary to ensure its use only for peaceful purposes.

5. THE GENERAL ASSEMBLY,

FURTHER RECOGNIZES that essential to the general regulation and reduction of armaments and armed forces is the provision of practical and effective safeguards by way of inspection and other means to protect complying States against the hazards of violations and evasions.

Accordingly,

THE GENERAL ASSEMBLY,

RECOMMENDS to the Security Council that it give prompt consideration to the working out of proposals to provide such practical and effective safeguards in connection with the control of atomic energy and the general regulation and reduction of armaments.

6. To ensure the adoption of measures for the early general regulation and reduction of armaments and armed forces, for the prohibition of the use of atomic energy for military purposes and the elimination from national armaments of atomic and all other major weapons adaptable now or in the future to mass destruction, and for the control of atomic energy to the extent necessary to ensure its use only for peaceful purposes,

THERE SHALL BE ESTABLISHED,

within the framework of the Security Council, which bears the primary responsibility for the maintenance of international peace and security, an international system, as mentioned in paragraph 4, operating through special organs, which organs shall derive their powers and status from the convention or conventions under which they are established.

7. THE GENERAL ASSEMBLY,

regarding the problem of security as closely connected with that of disarmament,

RECOMMENDS the Security Council to accelerate as much as possible the placing at its disposal of the armed forces mentioned in Article 43 of the Charter;

IT RECOMMENDS the Members to undertake the progressive and balanced withdrawal, taking account of the needs of occupation, of their armed forces stationed in ex-enemy territories, and the withdrawal without delay of armed forces stationed in the territories of Members without their consent freely and publicly expressed in treaties or agreements consistent with the Charter and not contradicting international agreements.

IT FURTHER RECOMMENDS a corresponding reduction of national armed forces, and a general progressive and balanced reduction of national armed forces.

8. Nothing herein contained shall alter or limit the resolution of the General Assembly passed on 24 January 1946, creating the Atomic Energy Commission.

9. THE GENERAL ASSEMBLY,

CALLS upon all Members of the United Nations to render every possible assistance to the Security Council and the Atomic Energy Commission in order to promote the establishment and maintenance of international peace and collective security with the least diversion for armaments of the world's human and economic resources.

After the passage of this resolution, the General Assembly passed, by 36 votes to 6, with 4 abstentions, a resolution terminating the troop and armament census controversy by assigning to the Security Council the task to determine what data the individual nations should be asked to supply to assist in the implementation of the disarmament resolution.

* * *

As far as the control of atomic energy is concerned, the main results of the disarmament debate were:

(1) The three concessions made by the U.S.S.R.

(a) in agreeing to "talk inspection",

(b) in conceding that the day-to-day operations of the control bodies should be free of "veto" restrictions; and

(c) in approving that these bodies should derive their authority from a treaty or convention ratified by member nations.

(2) The concession of the U.S. in placing the control organs explicitly "within the framework of the Security Council."

The question of the abolition of veto in dealing with violators of the disarmament conventions—which loomed so large in the discussions of the Atomic Energy Commission — was not brought up at all in the disarmament discussions in the General Assembly. This fact was quoted by Walter Lippman as an example of the absence of co-ordination in the U.S. foreign policy.

Proceedings of the UN Atomic Energy Commission

On December 5, the Seventh plenary meeting of the Atomic Energy Commission was held, with Alexandre Parodi (France) in the Chair. The Chairman explained that he called this meeting because of the discussion of the disarmament problem by the General Assembly. He said:

"It might be useful to point out that we have been working on this question for many months, that we have found it a particularly difficult subject to deal with, and that we are about to reach satisfactory results. It would be regrettable, therefore, if the Committee of the General Assembly dealing wih disarmament matters should now interfere with the progress of our Commission.

General McNaughton (Canada): "As we know in this Commission, the problem of doing away with the menace of atomic warfare is not simply a matter of prohibiting the production and use of the atomic bomb. If we are to derive the full benefits of the peaceful use of atomic energy, we must devise measures to so control the production and use of atomic energy that at no stage can atomic energy be used for the production of atomic weapons.

"We realize that a plan for the international control of atomic energy, to be effective, must involve an unprecedented departure from traditional concepts of national sovereignty. I feel sure that the Governments of all the Members of the United Nations will be prepared to do what is necessary to create an effective system of control. But in any proposals of this Commission we must also be able to convince our people that each of the obligations which such a system will involve is necessary for their common safety and for their general welfare.

"We are coming, as we know, shortly to the time when we shall submit a report to the Security Council. That report will be the first which will bring together all the work which we have done up to this time. In submitting that report, Mr. Chairman, we should keep in mind that it goes not only to the Security Council, but also that the report should carry conviction and command the intelligent comprehension and support of the wider public."

The above statements as well as subsequent speeches by the delegates of Australia and Great Britian reflected the apprehension that the debate in the Assembly might nullify the progress achieved by the Atomic Energy Commission, by submerging the problem of atomic energy controls in the wider problem of general disarmament. The American delegation moved immediately to counteract any such development.

Mr. Baruch: My fellow members of the Atomic Energy Commission: The primary responsibility for originating a system to protect the world against the atomic bomb has been placed squarely in our hands.

I note that the debates on disarmament in the General Assembly have followed closely the proposals laid down by the United States on June 14, before this body. It remains, however, the responsibility of this Commission to submit definite plans to the Security Council.

We believe that the original proposals of the United States, made on June 14, were generous and just. Through the acid test of deliberation and debate before this Commission and before the public opinion of the world, they have been proven so. In the long and protracted series of seventy-odd meetings of this Commission and its various committees, we have found inherent and inevitable in any treaty that is to be written covering this subject three major elements:

1. The erection of an international authority which shall effectively prevent the manufacture and use of atomic bombs for war purposes, and which shall develop the use of atomic energy for social gain.

2. The right of free and full international inspection in support of these purposes.

3. The definite agreement that once a treaty becomes effective, providing for deterrents against offenses and punishments for offenders, there can be no veto to protect wilful violators or to hamper the operations of the international authority.

We seek especially the participation of the Soviet Union. We welcome the recent authoritative statements of its highest representative. From these, we are justified in concluding that it no longer regards the original American proposals unacceptable, as a whole or in their separate parts, as its member of this body stated at an earlier meeting.

Mr. Baruch then read the draft of a resolution which was later substantially incorporated in the "Findings" and "Recommendations" in the Report reprinted on pages 16-27 of this issue.

Mr. Baruch's proposals were supported by delegates of Brazil and Egypt, while Mr. Gromyko asked for time to study them.

* * *

The Eighth plenary meeting of the Atomic Energy Commission was held on December 17—three days after the adoption of the disarmament resolution by the General Assembly. The new Chairman, the physicist, Dr. Vallarta, (Mexico) opened the meeting with the statement that it was called on the request of the U.S. delegation. In a short address he said:

"Much has been said already on the importance of a satisfactory form of control of atomic energy to save the world from an armament race and from the terrible horrors which accompany the use of atomic weapons. Not so much has been said on the fate of pure science which is also closely connected with the subject of our discussions. The future of pure scientific research is at stake with unpredictable consequences for the future of mankind, for without a satisfactory form of control of atomic energy there is great danger that research leading to the discovery of scientific truths will eventually stop altogether, that the exchange of scientific information will be so seriously curtailed as to disrupt the international brotherhood of science, that scientists will devote their efforts to the invention of more deadly means of warfare and will work in segregated groups, each bent on securing for their respective nation the greatest possible advantage in war."

Mr. Baruch then pressed for the adoption of the American draft resolution.

Mr. Baruch (United States): "I propose to move the adoption of the Resolutions submitted to this body on Thursday, December 5.

"We are under compulsions placed upon us by the General Assembly. The great and solemn debate held by that body on Disarmament was closed last Saturday night, with an expression of unanimous support by all the nations represented.

"A new spirit has come into being. It is our privilege and duty to give flesh to that spirit. The injunction has been laid upon the Atomic Energy Commission to proceed expeditiously to the development of a formula of action. It is with that thought in mind that I requested the Chairman of this group to call us together.

"Upon rendering its report to the Security Council, the Commission will have completed the first stage of its assigned task. It will then, presumably, turn to the difficult questions of the organization, functions, powers, and the relations of the proposed international control agency to the United Nations and to the several states. However, before such discussions can be fruitfully undertaken, we must first establish a general framework within which the solutions will be sought. The resolutions proposed by the United States are offered to provide such a basis, in order that the work of this Commission may continue fruitfully and its past efforts not be lost.

Sir Alexander Cadogan (United Kingdom): "I beg to second the proposal of the representative of the United States that these findings and recommendations which he has laid before us shall be incorporated in the report which our Commission will have to make to the Security Council."

* * *

The American delegation obviously decided that the necessity of presenting a report to the Security Council by the end of the year, and the call of the General Assembly for rapid action, offered favorable conditions for pressing for the adoption of the Baruch plan practically in toto. *This pressure met with considerable resistance. As expected, opposition was voiced mainly against the inclusion, into the report, of the idea which was the main addition of Mr. Baruch to the Acheson-Lilienthal blueprint, and for which Mr. Baruch and his colleagues have fought consistently and vigorously—the abolition of the veto power in action against nations violating the atomic energy controls. As mentioned before, no such change in the Security Council voting rules was pressed for by the American delegation in the disarmament debate in the General Assembly —although the arguments of Mr. Baruch for its inclusion into the recommendations of the Atomic Energy Commission could be equally well applied to the disarmament problem as a whole.*

* * *

Amendments of the Baruch resolution "bringing it into closer correspondence with the disarmament resolution of the Assembly," were advocated by Canadian, French, and other delegations.

General McNaughton (Canada): "I believe that our report must take full account of that historic document entitled 'Principles governing general regulation and reduction of armaments' which was approved unanimously by the General Assembly last Saturday.

"I think it must have been evident to all who had the privilege of hearing the discussions in the General Assembly that a great measure of agreement had been reached on matters which are before this Commission. Mr. Molotov's statements give us all reason to believe that we are in agreement on the essentials.

"This matter of the veto applied to enforcement measures undertaken by an international authority or the Security Council will need very careful consideration before any final conclusions can be reached. I would at this time like to draw the attention of the Commission to the views of my Government as stated by the Secretary of State for External Affairs speaking in the First Committee of the General Assembly on December 4th: 'Any sanctions that might have to be adopted against a state which violated, or which adopted a position that constituted a threat of violation (of the convention or conventions) should be subject to sanctions adopted by and applied through the Security Council...There again, the existence of the requirement of unanimity (of the great Powers) appears to me to be in strict accord with the realities of the situation...If there came about a situation where it was felt that (military) sanctions would have to be applied against one of the Great Powers, it would be a condition of absolute war whether the opposition of the one power took the form of resistance or took the form of a veto. The only way in which it could be overcome would be by the use of force and the use of force against a Great Power means war.'

"From what I have said about sanctions, it will be evident, I think, that we must be very careful in the phrasing of this report."

Mr. Gromyko (U.S.S.R.): "I would not like to speak at this meeting on the substance of the proposal which has been made by Mr. Baruch, mainly because I have not had enough opportunity to study this proposal from the point of view of its concordance with the decision of the General Assembly which was reached two days ago.

"Mr. Baruch distributed his document concerning atomic energy control on December 5th. The Resolution of the General Assembly, which also includes certain provisions concerning the control of atomic energy, has only been passed on December 14.

"I can now already see that this proposal is not in all respects in conformity with the decision of the General Assembly. More particularly, the resolution of the General Assembly does not touch on the veto question in any way, and this is quite reasonable and understandable, because if it did—if a General Assembly delegation would have insisted on the conception which has been given to this particular aspect of the problem by Mr. Baruch, there would have been no possibility for unanimity in the General Assembly.

"What is proposed now by the United States delegation is to ignore the Charter in the case of the sanctions which would be taken against the violators of the prohibition of production and the use of atomic weapons. This is obviously a violation of the Charter.

"The reason we should take no decision now is because I imagine that we want to reach a unanimous agreement. I very strongly feel that it is necessary to find a common language to deal with this question and we must study the document which has been submitted and circulated by Mr. Baruch."

Mr. Van Cleffens (Netherlands): "It is true that there is not any mention in the General Assembly resolution of that paragraph which in Mr. Baruch's text says that 'the violator of the terms of the treaty should not be protected from the consequences of his wrong-doing by the exercise of any power of veto'.

"If that is the main difficulty in obtaining general agreement, we might perhaps reserve that paragraph indicating very clearly who are at this present moment able to accept and who are not able to accept it."

Mr. Quo (China): "In principle, if it comes to a vote, we will vote for the Baruch resolutions, but, as our Soviet colleague has said, it may be desirable to have a unanimous decision by our Commission."

Mr. Lange (Poland): "We have now before us the resolution of the General Assembly which lays down certain special principles which the Security Council is to follow in matters of Atomic Energy.

"Among these principles there has been adopted the principle of international control, a principle which was very strongly advocated by Mr. Baruch. I think Mr. Baruch can be congratulated on the fact that his principle has been unanimously adopted by the General Assembly. The problem before us is to lay down the details as to how such a control scheme should be carried out.

tive of the United States proposes actually is a revision of the Charter. The fact that the American proposals provide for a voluntary relinquishment of the so-called veto by the permanent Members of the Security Council does not change the situation, since any changes in the Charter presuppose a voluntary agreement on such changes by all permanent Members.

"We are told: either treaty on control of atomic energy or veto. However, the putting of the question itself is incorrect. In reality, our task is to reach an agreement on the basis of the principles of the United Nations Charter and of the decision of the General Assembly adopted on December 14th. One can hear also the statement to the effect that only those nations want to protect the principle of unanimity in connection with atomic energy control which may have an intention of breaking the treaty on the control. Such light-minded statements are a play of words. The fact that someone resorts to statements of such a kind can be explained only by the absence of more convincing argument.

"In the light of what I have said it is possible to understand the concern which was shown by the representatives of some States in the Atomic Energy Commission in relation to the paragraph 3(e) of the part "Recommendations" of the proposals of the United States representative, in which the recommendation concerning the principle of unanimity of the permanent Members of the Security Council is contained. I have in mind in particular the opinion expressed by the representative of France. In this connection, however, I consider it necessary to state that it is insufficient to make only some modifications in the wording of the above-mentioned paragraph of the United States proposals, leaving the basic sense of that paragraph unchanged. It is not only the matter of language and wording, but of the contents of the paragraph.

"In spite of the serious defects of the proposals of the United States representative the Soviet Government has no objection to discuss these proposals in detail. The Soviet Government considers it necessary that the above-mentioned and other defects in the American draft be removed and that the submitted draft be brought into conformity with the decision of the General Assembly and with the Charter of the United Nations."

* * *

Mr. Gromyko then returned to the original Soviet proposal to expedite the prohibition and destruction of atomic weapons independently of the general regulation of atomic energy:

"It is necessary to separate the question concerning the prohibition of atomic and all other weapons adaptable to mass destruction in order to take an urgent decision on it.

"An urgent decision on this question would constitute the first important and practical step towards the fulfillment of the decision adopted by the General Assembly on December 14.

"The decision of the General Assembly has also recognized as an urgent objective the establishment of international control of atomic energy and other modern scientific discoveries and technical developments, to insure their use only for peaceful purposes. It is indisputable that control organs and organs of inspection should carry out their control and inspection functions, acting on the basis of their own rules which should provide for the adoption of decisions by a majority in appropriate cases. Besides, the international system of control must insure the fulfillment of obligations concerning the use of atomic energy by all nations only for peaceful purposes.

"Following the above stated considerations, the Soviet Government proposes to consider the proposals of the United States representative submitted on December 5, 1946, concerning the control of atomic energy, item by item in order to include absolutely necessary corrections and to proceed without delay with preparation of the International Convention on the prohibition of the production and use of atomic and other major weapons adaptable to mass destruction, having in mind the draft convention submitted by the Soviet Government on June 19, 1946."

Mr. Baruch (United States): "Mr. Chairman, I move that the draft of the report AEC/18, as forwarded to this Commission by the Working Committee, be adopted as the report of this Commission, to be submitted to the Security Council on December 31, 1946."

Mr. Hasluck (Australia): "As I understand the last paragraph of the Soviet statement, it contains a proposal to consider the United States proposals of December 5th, paragraph by paragraph.

"The representative of the Soviet Union has put forward a statement which contains three main points.

"In the summing up that was given at the end of June by the first Chairman of this Commission, the Foreign Minister of Australia, those same three problems were isolated, and for six months, if not the Soviet representative, at least the other Members of this Commission have been working on those three problems, and having worked on them for six months, we have arrived at a report. And now, the Soviet representative, who, during the past fortnight at least, has not participated in the work of this Commission, wants us to go back to June, start all over again, and as it were, set aside this report.

General McNaughton (Canada): "Our attitude in relation to this report can be stated very simply: In our view, its main purpose is to record the large measure of agreement reached in the Commission on the fundamental principles involved in the international control of atomic energy and on the methods by which this can be achieved.

"In the Working Committee, we have had full opportunity to discuss, consider, and revise the proposals of the United States delegation of December 5, item by item, in the same manner as other parts of the report. We have, in fact, made many changes. If there are delegations which have not taken advantage of these opportunities, that is their misfortune, and ours too. But this should not, however, prevent us from coming to a decision now as we have previously agreed to do, by the 31st of December, that is, tomorrow.

"We have had, I think, ample opportunity for discussion of our report. I remind you that this is an interim report. It records the agreements which we have reached on the scientific and technical aspects of the problem, and it gives some, at least, of the safeguards which must be provided to insure that atomic energy should not be turned to destructive uses.

"The report also contains findings and conclusions of a political character, and these include the three paragraphs referred to in the Chairman's covering letter. It seems evident from the discussion which has taken place, that these paragraphs represent the greatest measure of agreement that can be secured on these matters at this time, and therefore, the Canadian delegation accepts these paragraphs for inclusion in the report.

"It was not because of any liking for the veto that we questioned at an earlier stage the desirability of including a reference to it in this interim report. It was merely that we thought such a reference to the veto was premature, that it would carry our discussion beyond the area of possible common agreement at this time, and thus might prejudice the prospects of acceptance of this, our first report, not only in this Commission, but also in the Security Council. We must not forget that all we are doing is to report to the Security Council itself, a fact which I think removes most of the force of objections raised by the representative of the Soviet Union."

Sir Alexander Cadogan (United Kingdom): "The objection that the report is inconsistent with the resolution of the General Assembly of December 14, in that it proposes the establishment of international control of atomic energy within the framework of the United Nations Organization instead of within the framework of the Security Council, I cannot accept as valid. After all, the greater includes the less, and the phrase used in the report cannot deprive the Security Council of any of its powers or relieve it of any of its responsibilities.

"As regards the question of the veto raised by the representative of the Soviet Union, I must declare that my Government attach the greatest importance to the principle that there must be no veto protection of violators of the convention. I had myself wondered whether a critical passage of the report dealing with this point might not have been otherwise worded, and had hoped that somewhat differently stated it might, at that stage, even have commanded unanimous acceptance. But it is now clear, I think, that the Soviet Government does not accept the principle itself, which I have enunciated regarding the protection of violators, and that no mere verbal changes in the report would win their approval at this stage."

Mr. Parodi (France): "I would like to point out most definitely that insofar as the French delegation is concerned, there is no disagreement in substance on the text which is now before us.

"When the First Committee of the General Assembly examined the question of control, we stated at that time that we could not conceive of a system of control whereby a state or body being controlled could at the same time oppose the exercise of control. In connection with sanctions, we also stated that if sanctions were necessary, one of the primary conditions should be that they be efficiently applied.

"I think, in particular, that we must give all the precision necessary to a system which, in the last stage of sanctions, would mean war, and we must be careful that this war would not be waged in violation of International Law.

"Therefore, I want to point out most clearly that in substance we fully support the United States proposal. If there are any divergencies which have arisen, they are mainly divergencies in the method of procedure. From the very beginning of the six or eight months we have worked, we have stated that we should like to proceed in such a way that the result would be attained unanimously.

At one time in the past we were in a situation when the Commission felt that we were at an extremely difficult impasse —I believe it was in the beginning of August. It was at that time that it was proposed that the question be studied more completely, that first the scientific aspects of the question be studied before approaching the subject of the control itself, from the point of view of concessions of sovereignty.

"Because of this very sound basis which we adopted, we came out of our difficulty, I feel, and proceeded to progress quite substantially in the work of the Commission.

"So I must say that I differ from some of my colleagues who show a certain amount of impatience with the work which has been done in the past six months. I believe that in the first three months we were confronted with a good many difficulties; but in the last three months, we reached a substantial agreement on principle, and I believe, as a matter of fact, that we reached a unanimous decision insofar as a solution on the main principles is concerned.

"Now, insofar as the report before us is concerned: The French delegation has only one reservation concerning the three words: '. . . veto or otherwise . . .'

"I believe that these three words have been interpreted differently by the delegation of the United States and by the delegation of the Soviet Union. Mr. Gromyko has stated that this was tantamount to a modification of the Charter. On the other hand, Mr. Baruch stated, in no less precise terms, that no modification of the Charter would be asked.

"The report which includes the words 'veto or otherwise,' has been submitted by the United States, so I believe that the interpretation which is given to this wording by the United States delegation is the one which should be retained as the authentic interpretation."

Mr. Lange (Poland): "We consider agreement among the permanent Members of the Security Council as a necessary basis towards obtaining any practical results on the problem of control of atomic energy. I must, therefore, register with great dismay that up till now, there still is a substantial amount of disagreement on the content of the report which is before us.

"Several times at our earlier meetings great insistence was put upon reaching an immediate vote. As the representative of Poland, I expressed myself on these occasions against taking votes for I believe that this can lead only to an increase in the differences among us with stress of these differences, rather than to further attempts at conciliation. With particular dismay, I want to note that at the last meeting of Committee 2, one of the representatives in his statements said that he would urge his Government to withdraw their support from this Organization—meaning the United Nations Organization—if his proposals were not adopted. It is the first time in the history of the United Nations that a representative of a Government which is both a Member and founder of this Organization has threatened to withdraw support from our Organization if one of its proposals is not adopted."

Mr. Baruch (United States): "I suggest we take a vote, Mr. Chairman."

Mr. Lange (Poland): "Mr. Chairman, I had originally made a proposal that we pass this report as an interim report to the Security Council, without vote. I had made no formal motion of that type, and I do not intend to make such a formal motion. If the majority of the Commission prefers to take a vote, I shall not object.

"Wishing to economize the time of the Atomic Energy Commission, I shall refrain from proposing amendments.

"I suggest that, instead, the Chairman in presenting the report which we adopt here to the Security Council write a letter of transmittal, in which he says that certain passages were not approved by all the delegations.

"We do not want to vote against the report, because we do not want to disparage in any way the great and fundamental agreement which already has been achieved. And, in underlining this general agreement, we shall abstain from voting."

Chairman: "We shall now proceed to take the vote."

The vote was taken with the following results: Yes, Australia, Brazil, Canada, China, Egypt, France, Mexico, Netherlands, United Kingdom, and United States; No, none; and Abstention, Poland and U.S.S.R.

* * *

The letter of transmittal to the Security Council has not yet been made public at this writing. According to newspaper reports Poland has filed with the Chairman of the Atomic Energy Commission, its reservations concerning the "veto" provisions. There is no indication that U.S.S.R. intends to make any similar statement. Such a statement would imply acceptance of the rest of the report—an important commitment which the procedure adopted by the Commission, on the insistence of the American delegation, has failed to extract from the Soviet delegation.

The Scientific and Technical Committee met on 1 August to discuss questions posed by Committee 2. Meeting almost daily for informal discussions, the scientists prepared a report which was completed by the end of August. Final action, however, was not taken until 26 September, when the report, included in its entirety as Part IV of this report, was adopted unanimously by the Scientific and Technical Committee, subject only to the following reservation on the part of the Representative of the Union of Soviet Socialist Republics: "The information at the disposal of the Committee was as the report acknowledges, limited and incomplete. For this reason, the majority of the conclusions in the Committee's report are hypothetical and conditional. It is with this reservation that I vote for the adoption of the report."

The approach of the Scientific and Technical Committee to its work is indicated in the following statement from the Introduction to its report: "At the beginning of our discussion, it was realized that a broad exploration of the technically possible methods of controlling atomic energy to ensure against its use as a weapon would inevitably lead us to the consideration of problems of a non-technical or political nature, which would have to be taken into account in a system of control. Since political matters are wholly within the jurisdiction of other committees of the Atomic Energy Commission, it was decided to limit ourselves strictly to the scientific and technical aspects of the question."

The report outlines the basic scientific and technical facts in the production and peaceful use of atomic energy and points out the dangers which would result from the diversion of materials, from clandestine operations and from seizure. It concludes with the statement that "...we do not find any basis in the available scientific facts for supposing that effective control is not technologically feasible."

Committee 2 held its sixth meeting on 2 October to consider the report of the Scientific and Technical Committee and decided to continue its discussions on the basis of the report. On 8 October Committee 2 unanimously adopted the following resolution proposed by the Representative of Canada:

"That Committee 2 proceed to examine and report on the safeguards required at each stage in the production and use of atomic energy for peaceful purposes to prevent the possibilities of misuse indicated in the Report of the Scientific and Technical Committee; that the Committee may hold informal meetings as it may decide, at which scientific Representatives may take part in the discussions."

In accordance with this resolution, a program of work was outlined by the Secretariat (Annex 7, A Suggested Program of Work). The Committee, on 14 October, agreed to consider, first, the types of safeguards necessary for preventing diversion at various stages in the process of producing atomic energy; measures for detecting and preventing clandestine operations and seizure of plants would be considered later. Topics for consideration were based upon the sequence of activities set forth in the Scientific and Technical Committee's report as follows:

(1) Uranium and thorium mines.
(2) Concentration plants.
(3) Refineries.
(4) Chemical and metallurgical plants.
(5) Primary reactors and associated chemical separation plants.
(6) Isotope separation plants.
(7) Secondary reactors.

Beginning on 15 October, informal conversations were held about twice a week in order to discuss in detail the types of safeguards necessary at each of the above steps and to hear statements by experts. The discussions carried forward by this informal group resulted in a draft report, completed on 13 December, dealing with safeguards against diversions and clandestine activities. Preliminary consideration was given to the problems of seizure and of the co-ordination of safeguards.

The Atomic Energy Commission meantime held its sixth meeting on 13 November and resolved to prepare a progress report to be presented to the Security Council by 31 December 1946, when the membership of the Commission changes in consequence of the election of new Members to the Security Council. The report was to include an account of the proceedings, findings, and recommendations of the Commission based on its deliberations to date. The report was to be drafted by Committee 2.

While this report was being prepared, the Second Part of the First Session of the General Assembly was considering various proposals concerned with the regulation and reduction of armaments, including atomic weapons. Accordingly, the Chairman called the seventh meeting of the Commission on 5 December and invited comments on the implications for the Commission of the discussion going forward in the Assembly. The sense of the meeting was that the Chairman should convey to the appropriate committees of the Assembly the view of the Commission that the work of the Commission should not be prejudged and that no action should be taken which would preclude or delay the Commission from the early completion of its task. (Verbatim Records of Meetings of the Atomic Energy Commission on 13 November and 5 December, Documents AEC/PV/6 and AEC/PV/7).

On 14 December 1946, the General Assembly approved unanimously the following resolution, which includes many important clauses affecting the Commission:

At the seventh meeting of the Commission on 5 December, the Representative of the United States presented certain items which he proposed be adopted at a subsequent meeting of the Commission for inclusion in the findings and recommendations contained in its report to the Security Council. At its eighth and ninth meeting on 17 and 20 December, the Commission met to discuss these proposals (Verbatim Records of Meetings of the Atomic Energy Commission on 17 and 20 December, Documents AEC/PV/8 and AEC/PV/9). On 20 December, the Commission approved and accepted the principles on which these proposals were based, in the terms of the following resolution:

"Resolved that the Commission approves and accepts the principles on which the Findings and Recommendations, proposed by the Representative of the United States of America and contained in Document AEC/15/Rev. 1, are based, and instructs the Working Committee to include these Findings and Recommendations in the draft of the Commission's report to be delivered to the Security Council by 31 December 1946, having conformed the wording of such portions of these Findings and Recommendations as deal with the same subject matter to the wording of the relevant parts of the Text of the General Assembly Resolution of December 14, 1946 on the 'PRINCIPLES GOVERNING THE GENERAL REGULATION AND REDUCTION OF ARMAMENTS'."

Many important questions, which have been considered only in broad outline during the course of its deliberations, remain to be further studied by the Commission. These questions include: the detailed powers, characteristics, and functions of the international control agency for which the need is expressed in the "First Report on Safeguards Required to Ensure the Use of Atomic Energy Only for Peaceful Purposes", including such matters as organization, financing and staffing; the relationships between the agency, the various organs of the United Nations, and the participating States; powers of the agency in matters of research, development, and planning; the provisions for transition to the full operation of the international system of control; and other specific matters which should be included in the treaty or convention establishing control over atomic energy.

(The full text of the Disarmament Resolution can be found on page 9 of the Bulletin.)

PART II.

FINDINGS.

A. Findings on the Scientific and Technical Aspects of the Problem of Control.

The Report of the Scientific and Technical Committee on Scientific and Technical Aspects of the Problem of Control, included in its entirety as PART IV of this report, was accepted by Committee 2 as a basis for its future work. The Commission now records its approval of that report and incorporates in its present findings the conclusions summarized therein in Chapter VI, as follows:

"The substances uranium and thorium play a unique role in the domain of atomic energy, since as far as we know these are the only raw materials from which the nuclear fuel required for the development of atomic energy can be obtained. There is an intimate relation between the activities required for peaceful purposes and those leading to the production of atomic weapons; most of the stages which are needed for the former are also needed for the latter. The character of the different stages of the activities has been discussed in order to explore at each stage the elements of danger and to some extent the problem of safeguards against these dangers.

"With respect to mining operations, which are of special significance as the first step in these activities, it appears hopeful that safe-

guards are not too difficult. Particular attention should be paid to the installations in which concentrated nuclear fuel is produced since the product lends itself immediately to the production of bombs. Unless appropriate safeguards are taken at each of these stages, it will be difficult to insure that no diversion of material or installations will take place.

"With regard to the question posed by Committee 2, 'whether effective control of atomic energy is possible,' we do not find any basis in the available scientific facts for supposing that effective control is not technologically feasible. Whether or not it is politically feasible is not discussed or implied in this report, nor is there any recommendation of the particular system or systems by which effective control can be achieved."

B. Findings on the Safeguards Required to Ensure the Use of Atomic Energy Only for Peaceful Purposes.

The safeguards required at each stage in the production and use of atomic energy for peaceful purposes to prevent the possibilities of misuse indicated in the report of the Scientific and Technical Committee were examined at length in the Informal Conversations of Committee 2. A report on the subject, called the "First Report on Safeguards Required to Ensure the Use of Atomic Energy Only for Peaceful Purposes," was duly prepared, has been approved by the Commission, and is incorporated as PART V of this report.

The summary of the findings of that report is given below. These findings have led to the important conclusion that an international control agency must be responsible for the system of safeguards and control. They also indicate some of the essential functions of the agency. The specific control measures mentioned in the findings are not meant to be definitive but rather to be indicative of the various types of safeguards applicable at each stage. In devising a definite system of control, provision must be made for flexibility in adapting safeguards to a rapidly developing technology. Moreover, the findings are interrelated and, although the co-ordination of safeguards is discussed to some extent, further measures of co-ordination must be considered before formulating a comprehensive system of control. The findings, therefore, do not represent a plan for atomic energy control but only some of the elements which should be incorporated in any complete and effective plan.

SUMMARY OF FINDINGS ON SAFEGUARDS NECESSARY TO DETECT AND PREVENT DIVERSION FROM DECLARED ACTIVITIES.

DIVERSION OF URANIUM FROM DECLARED MINES AND MILLS.

Adequate safeguards against diversion from declared mines and mills are possible by a system of inspection, including guards, similar to normal managerial operating controls, provided that the inspectorate has unrestricted access to all equipment and operations and has facilities for independent weighing, assay, and anaylsis.

DIVERSION OF THORIUM FROM DECLARED MINES AND MILLS.

Effective control of the raw material and concentrates of thorium is possible through a system of inspection similar to that found adequate for uranium.

DIVERSION OF URANIUM AND THORIUM FROM DECLARED REFINERIES AND CHEMICAL AND METALLURGICAL PLANTS.

Adequate safeguards against diversion from declared refineries and chemical and metallurgical plants are possible by a system of inspection, including guards, similar to normal managerial operating controls, provided that the inspectorate has unrestricted access to all equipment and operations and has facilities for independent weighing, assay, and analysis and provided that it has the right to require the plant to be shut down for purposes of clean-up and accounting at appropriate times and to require efficient operating procedure.

At these stages, there is no fundamental difference between the processes for thorium and for uranium.

DIVERSION OF URANIUM FROM DECLARED ISOTOPE SEPARATION PLANTS.

At present, it is not possible to place reliance on the method of obtaining a material balance of uranium isotopes in the case of isotope separation plants. This is one of the important reasons why there must be internal control of such plants by a director or manager and why the management must be established by and be responsible to the international control agency. Even if the material balance could be greatly improved, the inherent danger of the operation would still require management by the international control agency.

DIVERSION OF URANIUM, THORIUM, AND PLUTONIUM FROM DECLARED NUCLEAR REACTORS AND ASSOCIATED CHEMICAL EXTRACTION PLANTS.

A. At present, it is not possible to place reliance on the method of obtaining a material balance of plutonium in the case of reactors and associated chemical extraction plants. This is one of the important reasons why the chemical extraction plants and, in some cases, the reactors should be subject to internal control by a director or manager and why the management must be established by and be responsible to the international control agency. Even if the material balance could be greatly improved, the inherent danger of the operations would still require management by the international control agency.

B. The safeguards required for the control of reactors will depend on their size and design and especially on their content and possible rate of production of nuclear fuel. The safeguards available to the international control agency should include licensing and inspection, supervision, and management of the operation of reactors. In addition, close supervision of the design and construction of reactors is essential in all cases.

C. Periodic inspection, together with licensing, is an adequate safeguard in the case of small research reactors and their associated chemical plants, unless their total content of nuclear fuel or potential rate of output in any area is of military significance.

D. Adequate safeguards for chemical extraction plants associated with all except small research reactors are only possible through management by the international control agency.

E. Adequate safeguards during the preparation of high-grade or pure nuclear fuels in a suitable form for insertion in secondary reactors, and, during the storage and shipment of such fuels, are only possible through management by the international control agency.

SUMMARY OF FINDINGS ON SAFEGUARD NECESSARY TO ENSURE THE DETECTION OF CLANDESTINE ACTIVITIES.

A. The international control agency will require broad privileges of movement and inspection, including rights to conduct surveys by ground and air. These privileges should, however, be very carefully defined to ensure against misuse.

B. Reports and returns on relevant matters will be required from national governments.

C. The international control agency should co-ordinate all relevant information to determine what areas may be suspected of containing clandestine activities.

D. Isotope separation plants, reactors, and chemical extraction plants, as well as mines, have distinguishing features which would facilitate the detection of clandestine activities at these stages.

E. Detection of clandestine refineries and chemical and metallurgical plants is more difficult than detection of clandestine operations at other stages in the processing of nuclear fuel.

F. The detection of clandestine bomb manufacture as such is almost impossible; it is, therefore, vital that any unauthorized accumulation of essential nuclear fuels be prevented.

SUMMARY OF FINDINGS ON SEIZURE.

Problems relating to seizure have been considered thus far only in preliminary terms. The major questions of seizure are political rather than technical. It appears, however, that technical measures could reduce the military advantages and, therefore, the dangers of seizure.

SUMMARY OF FINDINGS ON CO-ORDINATION OF SAFEGUARDS.

A. In addition to material accounting at each individual step in atomic energy processes, the international control agency should provide for material accounting checks between points of shipment and receipt of material as a means of detecting possible diversion in transit.

B. The international control agency should control the storage and shipment of uranium and thorium materials to the degree necessary for security purposes.

C. The international control agency should itself store and itself handle all enriched or pure nuclear fuel in transit. This does not necessarily imply ownership either of the materials or of the transit or storage facilities, questions which have not yet been discussed.

D. Since stocks of concentrated or pure nuclear fuel are acutely dangerous, operations at successive stages in the production of atomic energy should be so scheduled that stocks of materials in transit and in storage are minimized, but without interfering unduly with the development and effectiveness of peaceful activities.

C. General Findings.

The findings of the "First Report on Scientific and Technical Aspects of the Problem of Control" and of the "First Report on Safeguards Required to Ensure the Use of Atomic Energy Only for Peaceful Purposes," while limited to the more technical aspects of the control of atomic energy, provide a basis for further progress by the Commission toward the fulfillment of the terms of reference set out in the General Assembly Resolution of 24 January 1946, establishing a commission to deal with the problems raised by the discovery of atomic energy and other related matters. The Resolution of 14 December 1946 of the General Assembly, entitled "Principles Governing the General Regulation and Reduction of Armaments," provides certain broad and essential political agreements. Based upon the proposals and information presented to the Commission, upon the hearings, proceedings, and deliberations of the Commission to date, and upon the proceedings, discussions, and reports of its several committees and sub-committees, all as set forth in this report, the Commission has made the following additional findings of a general nature:

1. That scientifically, technicologically, and practically, it is feasible,
   (a) to extend among "all nations the exchange of basic scientific information" on atomic energy "for peaceful ends",*
   (b) to control "atomic energy to the extent necessary to ensure its use only for peaceful purposes",*
   (c) to accomplish "the elimination from national armaments of atomic weapons",* and
   (d) to provide "effective safeguards by way of inspection and other means to protect complying states against the hazards of violations and evasions".*
2. That effective control of atomic energy depends upon effective control of the production and use of uranium, thorium, and their fissionable derivatives. Appropriate mechanisms of control to prevent their unauthorized diversion or clandestine production and use and to reduce the dangers of seizure—including one or more of the following types of safeguards: accounting, inspection, supervision, management, and licensing—must be applied through the various stages of the processes from the time the uranium and thorium ores are severed from the ground to the time they become nuclear fuel and are used. (Cf. "Summary of Findings on Safeguards Required to Ensure the Use of Atomic Energy Only for Peaceful Purposes", Part II B of this report.) Ownership by the international control agency of mines and of ores still in the ground is not to be regarded as mandatory.
3. That, whether the ultimate nuclear fuel be destined for peaceful or destructive uses, the productive processes are identical and inseparable up to a very advanced state of manufacture. Thus, the control of atomic energy to ensure its use for peaceful purposes, the elimination of atomic weapons from national armaments, and the provision of effective safeguards to protect complying States against the hazards of violations and evasions must be accomplished through a single unified international system of control and inspection designed to carry out all of these related purposes.
4. That the development and use of atomic energy are not essentially matters of domestic concern of the individual nations, but rather have predominantly international implications and repercussions.
5. That an effective system for the control of atomic energy must be international, and must be established by an enforceable multilateral treaty or convention which in turn must be administered and operated by an international organ or agency within the United Nations, possessing adequate power and properly organized, staffed, and equipped for the purpose.

   Only by such an international system of control and inspection can the development and use of atomic energy be freed from nationalistic rivalries with consequent risks to the safety of all peoples. Only by such a system can the benefits of widespread exchange of scientific knowledge and of the peaceful uses of atomic energy be assured. Only such a system of control and inspection would merit and enjoy the confidence of the people of all nations.
6. That international agreement to outlaw the national production, possession and use of atomic weapons is an essential part of any such international system of control and inspection. An international treaty or convention to this effect, if standing alone, would fail (a) "to ensure" the use of atomic energy "only for peaceful purposes"* and (b) to provide "for effective safeguards by way of inspection and other means to protect complying States against the hazards of violations and evasions,"* and thus would fail to meet the requirement of the terms of reference of the Commission. To be effective, such agreement must be embodied in a treaty or convention providing for a comprehensive international system of control and inspection and including guarantees and safeguards adequate to ensure the carrying out of the terms of the treaty or convention and "to protect complying States against the hazards of violations and evasions."*

* Commission's Terms of Reference, Article V, Resolution of the General Assembly, 24 January 1946.

PART III.

RECOMMENDATIONS.

Based upon the findings of the Commission set forth in PART II of this report, the Commission makes the following recommendations to the Security Council with respect to certain of the matters covered by the terms of reference of the Commission, which recommendations are interdependent and not severable, embodying the fundamental principles and indicating the basic organizational mechanisms necessary to attain the objectives set forth in PART II C, General Findings, paragraph 1 (a)-(d) above.

1. There should be a strong and comprehensive international system of control and inspection aimed at attaining the objectives set forth in the Commission's terms of reference.

2. Such an international system of control and inspection should be established and its scope and functions defined by a treaty or convention in which all of the nation Members of the United Nations should be entitled to participate on fair and equitable terms.

The international system of control and inspection should become operative only when those Members of the United Nations necessary to assure its success by signing and ratifying the treaty or convention have bound themselves to accept and support it.

Consideration should be given to the matter of participation by non-Members of the United Nations.

3. The treaty or convention should include, among others, provisions

(a) Establishing, in the United Nations, an international agency (hereinafter called "the agency") possessing powers and charged with responsibility necessary and appropriate for the prompt and effective discharge of the duties imposed upon it by the terms of the treaty or convention. Its rights, powers, and responsibilities, as well as its relations to the several organs of the United Nations, should be clearly established and defined by the treaty or convention. Such powers should be sufficiently broad and flexible to enable the agency to deal with new developments that may hereafter arise in the field of atomic energy. *The treaty shall provide that the rule of unanimity of the permanent Members, which in certain circumstances exists in the Security Council, shall have no relation to the work of the agency. No government shall possess any right of veto over the fulfilment by the agency of the obligations imposed upon it by the treaty nor shall any government have the power, through the exercise of any right of veto or otherwise, to obstruct the course of control or inspection.*†

The Agency shall promote among all nations the exchange of basic scientific information on atomic energy for peaceful ends, and shall be responsible for preventing the use of atomic energy for destructive purposes, and for the control of atomic energy to the extent necessary to ensure its use only for peaceful purposes.

The Agency should have positive research and developmental responsibilities in order to remain in the forefront of atomic knowledge so as to render the agency more effective in promoting the beneficial uses of atomic energy and in eliminating its destructive ones. The exclusive right to carry on atomic research for destructive purposes should be vested in the agency.

Research in nuclear physics having a direct bearing on the use of atomic energy should be subject to appropriate safeguards established by the international agency in accordance with the treaty or convention. Such safeguards should not interfere with the prosecution of pure scientific research, or the publication of

† The sentences in italics are the ones to which the letter of the chairman of the working committee refers as having not been positively agreed upon at the time of transmittal to the Commission.

its results, provided no dangerous use or purpose is involved.

Decisions of the agency pursuant to the powers conferred upon it by the treaty or convention should govern the operations of national agencies for atomic energy. In carrying out its prescribed functions, however, the agency should interfere as little as necessary with the operations of national agencies for atomic energy, or with the economic plans and the private, corporate, and State relationships in the several countries.

(b) Affording the duly accredited representatives of the agency unimpeded rights of ingress, egress, and access for the performance of their inspections and other duties into, from and within the territory of every participating nation, unhindered by national or local authorities.

(c) Prohibiting the manufacture, possession, and use of atomic weapons by all nations parties thereto and by all persons under their jurisdiction.

(d) Providing for the disposal of any existing stocks of atomic weapons and for the proper use of nuclear fuel adaptable for use in weapons.

(e) Specifying the means and methods of determining violations of its terms, setting forth such violations as shall constitute international crimes, and establishing the nature of the measures of enforcement and punishment to be imposed upon persons and upon nations guilty of violating the terms of the treaty or convention.

The judicial or other processes for determination of violations of the treaty or convention, and of punishments therefor, should be swift and certain. Serious violations of the treaty shall be reported immediately by the agency to the nations parties to the treaty, to the General Assembly and to the Security Council.

Once the violations constituting international crimes have been defined and the measures of enforcement and punishment therefor agreed to in the treaty or convention, there shall be no legal right, by veto or otherwise, whereby a willful violator of the terms of the treaty or convention shall be protected from the consequences of violation of its terms.

The enforcement and punishment provisions of the treaty or convention would be ineffectual if, in any such situations, they could be rendered nugatory by the veto of a State which had voluntarily signed the treaty.

4. In consideration of the problem of violation of the terms of the treaty or convention, it should also be borne in mind that a violation might be of so grave a character as to give rise to the inherent right of self-defense recognized in Article 51 of the Charter of the United Nations.

5. The treaty or convention should embrace the entire programme for putting the international system of control and inspection into effect and should provide a schedule for the completion of the transitional process over a period of time, step by step in an orderly and agreed sequence leading to the full and effective establishment of international control of atomic energy. In order that the transition may be accomplished as rapidly as possible and with safety and equity to all, this Commission should supervise the transitional process, as prescribed in the treaty or convention, and should be empowered to determine when a particular stage or stages have been completed and subsequent ones are to commence.

PART IV.

A FIRST REPORT ON THE SCIENTIFIC AND TECHNICAL ASPECTS OF THE PROBLEM OF CONTROL.

For this report, see *Bulletin* Vol. 2, No. 7-8, p. 6-13.

PART V.

FIRST REPORT ON SAFEGUARDS REQUIRED TO ENSURE THE USE OF ATOMIC ENERGY ONLY FOR PEACEFUL PURPOSES.

Chapter 1.

General Introduction.

The major task before the Atomic Energy Commission is to make specific proposals for the control of atomic energy in order to foster its use only for peaceful purposes and to prevent its use for destructive ends. This task has led us to an analysis of the types of safeguards necessary to afford protection against the hazards of violations and evasions. The report contains the first findings of Committee 2, limited to this aspect of the general problem. These findings have led to the conclusion that a single international control agency must be responsible for the system of safeguards and control. The Committee has not discussed the general characteristics of such an agency or its exact powers in the way, for example, of development, research, or the international planning of atomic energy production. Nor has it considered how the various safeguards would be administered in practice as part of an over-all system.

The report has been prepared in accordance with the following resolution adopted by Committee 2 on 8 October 1946:

"That Committee 2 proceed to examine and report on the safeguards required at each stage in the production and use of atomic energy for peaceful purposes to prevent the possibilities of misuse indicated in the Report of the Scientific and Technical Committee; that the Committee may hold informal meetings as it may decide, at which scientific Representatives may take part in the discussions."

The program of work adopted by Committee 2, on 21 October 1946, called for the consideration of three distinct kinds of possible misuse: diversion of materials, clandestine operations, and seizures of material or facilities. It was proposed that measures to prevent these possibilities of misuse be considered for each of the following stages in the production and use of atomic energy for peaceful purposes: uranium and thorium mines, concentration plants, refineries, chemical and metallurgical plants, primary reactors and associated chemical separation plants, isotope separation plants, and secondary reactors.

In the course of its deliberations, the Committee heard statements from a number of technical experts who furnished information on all the important stages from the raw material to the production of concentrated nuclear fuel and on other matters. The Committee desires to express its thanks to the Canadian, the United Kingdom, and the United States Delegations which arranged for these experts to attend meetings of the Committee. A list of these experts and the topics on which they tendered information is given in Annex 2.

In the course of the Committee's work, definitions of certain types of safeguards have been formulated and have been used throughout this report. **Control** as used in this report is a general term which includes any or all types of safeguards. The types of safeguards which have been specifically defined are as follows:

1. **Accounting for materials** means the systematic measurement and reporting in prescribed form of quantities of key materials entering and leaving an establishment or installation, in process, and in storage. It includes prescription of the points at which measurements must be taken, the methods of measurements, and the manner in which the data are summarized into accounts. Accounting is normally accompanied by measures of analysis and auditing to ensure conformity between the accounts and the facts. Analysis may be limited to an indirect check of the accounts to test them for consistency. In order to be thoroughly effective, however, accounting for materials must also be extended to direct and simultaneous auditing checks of the accuracy with which individual measurements are incorporated into summary accounts and the validity of the measurements themselves. This necessitates adequate independent observation of the measurements, tests of the accuracy of scales and other measuring instruments, and possibly independent duplicate measurements either on a sampling basis or as a whole. It also implies the right to obtain explanations of discrepancies. When auditing is extended to independent direct checks, it becomes one element in inspection.

2. **Inspection** means close and careful independent scrutiny of operations to detect possible evasions or violations of prescribed methods of operation. In addition to direct auditing measures as described above, inspection may include observation of points of ingress to and egress from an establishment or installation to ensure that materials and supplies are flowing in the prescribed manner, observation of the activities within the establishment or installation, and measures in the form of aerial or ground survey and otherwise to guard against clandestine activities. To be fully effective, the power of inspection may require that the operations be carried on in a specified manner in order to facilitate the inspection. In this event, inspection verges on supervision.

3. **Supervision** means continuous association and co-operation in day-to-day operations with the management, together with authority to require that the management comply with certain conditions so as

to facilitate the execution of measures of control. For example, it may include the right to require that plants be designed and constructed in such a manner as to hinder diversion of materials, the right to require that the processes be conducted in a specified manner, or the right to order cessation of operations to take a complete inventory of materials in process. The more extensive the intervention of the supervisors into such matters, the closer supervision approaches management itself.

4. **Management** means direct power and authority over day-by-day decisions governing the operations themselves as well as advisory responsibility for planning. Managerial control means internal control of a plant by a director or manager. Management by the international control agency means that the management is established by and is responsible to such an agency. Management is normally a prerogative of ownership but need not imply ownership.

5. **Licensing** is a type of safeguard in which the degree of control is determined by the licensing agreement. It means the granting of permission to conduct certain activities under specified conditions. The conditions may include accounting and reporting requirements, rights of inspection or supervision, conformity with approved plant design or processes, etc. Similar results may be obtained through the leasing of establishments or installations from the international control agency or through a management contract, where the conditions are specified in the lease or contract, but leasing is not a prerequisite of licensing.

As explained above, Committee 2 has stressed the specific types of safeguards which should be applied at the several stages in the production and utilization of atomic energy. By this method, the Committee has sought to reach conclusions concerning individual elements of control. While this method is a logical one and enables a study to be made of the separate parts of the problem, the findings thereby arrived at must be viewed in the light of the general objective of securing an effective and enforceable system of control. The detailed findings contained in Chapters 2 to 8, inclusive, are interrelated. The co-ordination of safeguards is discussed to some extent in Chapter 8, but further measures of co-ordination must be considered before formulating a comprehensive system of control.

The specific control measures mentioned in the findings are not meant to be definitive but rather to be indicative of the various types of safeguards applicable at each stage. In devising a definite system of control, provision must be made for flexibility in adapting safeguards to a rapidly developing technology. The findings are, moreover, of a technical nature. It has been assumed in the preparation of the report that the staff of the international control agency would be technically competent and loyal to the agency and that it would exercise its functions thoroughly but without encroaching on matters beyond the requirements of the implementation of its mission. It has been assumed, furthermore, that the agency would treat with the necessary discretion information which it acquires.

In considering the types of safeguards to be applied at particular points, the objective has been to provide effectiveness of control with the least interference in normal activities. An ineffective system of control would be worse than none. The interference in a country's normal activities introduced by an effective system of control would be small compared with the disturbances which would result from the defense measures necessary for protection against atomic weapons.

In the preparation of this report there has been no discussion of the type or character of the international control agency in which control authority is to be vested. The over-all powers required by an authority depend upon the functions entrusted to it. Only the functions of providing safeguards against diversion from declared establishments and of discovering clandestine operations have been considered. The question of seizure of atomic energy establishments or materials by a nation intending aggression has only been recognized as a problem for future consideration. The findings, therefore, do not represent a plan for atomic energy control but only some of the elements which should be incorporated in any complete and effective plan.

(A Summary of Findings on Safeguards is included in PART II.)

Chapter 2.

Safeguards Necessary to Detect and Prevent the Diversion of Uranium and Thorium from Declared Mines and Mills.

INTRODUCTION.

In the general problem of safeguards, the mines and ore deposits occupy a special position. A complete control at this stage would give a starting point from which it might be possible to keep track of potentially dangerous material through all its later stages. In this connection, the report of the Scientific and Technical Committee states: "A special significance must be attached to the devising of adequate safeguards against the diversion of raw materials, since none of the subsequent operations can proceed without uranium, or uranium and thorium."

FINDINGS FOR MINING AND MILLING OF URANIUM.

1. *In considering the diversion of uranium at the mining and milling stage, one need only be concerned with substantial quantities of material. Occasional petty theft by miners or mill operatives would not be a matter of consequence.*

The diversion of many tons of ore would be required to make a few pounds of the finished nuclear fuel.

2. *Safeguards to prevent diversion should be determined, to some extent, by the richness of the ore mined. They should be stringent at rich mines and might be less strict for low grade deposits.*

The uranium content of ores varies considerably, ranging from very rich uranium ore to deposits containing small fractions of one per cent of uranium. When considering the latter, the following points should be kept in mind:

Ores with a low uranium content are sometimes found in deposits which can be worked by open-pit methods. This means that operations may be scattered over a wide area, and such controls as could be set up at points of egress (e.g., from a mine shaft) would not be possible, unless the whole area were under guard and, if feasible, enclosed. It is probable that in the future substantial amounts of uranium will be derived from very low-grade ores containing other valuable elements. Clearly more rigorous safeguards would become necessary as the uranium becomes concentrated. One must also not overlook dumps of tailings from various mines, mills, and even from certain chemical plants, because these, too poor to have been worked so far for uranium, might contain a very appreciable total amount of this metal.

Knowledge of ore reserves in certain known mines would be a further safeguard against diversion. However, in most mines, sampling methods to prove ore reserves would be inaccurate and difficult to apply as a control measure.

3. *The system of accounting, guarding, and inspection of uranium mines and mills could follow the normal patterns ordinarily used in the control of mining and milling operations.*

Assuming that egress from the mines or mills is under control by guards checking the contents and destination of shipments, it would appear that substantial or systematic theft of ores or concentrates would probably be detected.

In addition to the physical guarding of its property, management normally has a system of control in its plants to ensure efficient operation. The controls used by the management are designed primarily with a view to detecting technical inefficiencies and ensuring and maintaining maximum recovery. They give a very close check on the flow of material over a long period of time, though they may be inaccurate over short periods.

Adequate facilities for weighing, assay, and analysis are required by the inspectorate. In the simplest case of inspection, the operating controls used by the mine and mill management could be examined and verified with comparative ease by the inspectorate. Under other circumstances, it might be necessary to duplicate controls by having a completely independent and reliable assaying and sampling laboratory. One such laboratory could service a number of mines and mills.

4. *An adequate system of inspection could be so organized as not to interfere seriously with normal mining and milling operations.*

Inspection of mines and mills is not a new problem but one that has been solved satisfactorily by government authorities inspecting managements to prevent the diversion of the raw materials under government control. It has been proved possible for an independent inspectorate to review the accounting procedures used by the management, check the weighing and assaying equipment, make independent observations, etc., without seriously hampering the management. Experience of this kind has been particularly in the field of precious minerals where very small diversions are important; inspection to detect large scale diversions should be even less of an interference.

5. *The inspectorate must have unrestricted access to all equipment and all phases of the operations and have facilities for independent weighing, assay, and analysis.*

It is clear that its complete independence of the local management must be unquestionable.

6. *The number of guards and inspectors required for uranium mines and mills would not be great as compared with the operating staff.*

The duties of the inspectors would require varying degrees of technical skill and could not be regarded as purely police functions. Persons could be regarded as qualified to serve as the head of a mine or mill inspectorate if, in addition to professional training and experience as engineers, they were given a short course of special instruction.

7. *The comparison of weights and assays of the shipped material at the exit from the mill and on arrival at destination would provide a necessary check on possible diversion in transit.*

Such checks are normally carried out in mining and refining and would be all the more important in the case of uranium concentrates.

SUMMARY.

Adequate safeguards against diversion from declared mines and mills are possible by a system of inspection, including guards, similar to normal managerial operating controls, provided that the inspectorate has unrestricted access to all equipment and operations and has facilities for independent weighing, assay, and analysis.

FINDINGS FOR MINING AND MILLING OF THORIUM.

1. *The danger inherent in the diversion of thorium is less immediate than in the case of uranium.*

Thorium cannot be used by itself for the production of atomic energy; it requires reactors which also use natural uranium or nuclear fuel.

2. *The control of thorium would be in some respects more difficult than in the case of uranium.*

The most common occurrence of thorium is in monazite sands; and the great extent of some deposits, which may be scattered over hundreds of miles, together with the relatively simple equipment required, makes illicit removals relatively easy. In view of the generally low content of thorium in the sands, however, only a large quantity of material would be significant, and frequent or large scale illicit operations would probably be readily discovered.

3. *Controls for thorium could still be of the same type as those for uranium.*

The problems involved in the control of diversion from declared thorium deposits are fundamentally the same as those met in the control of uranium. A system of inspection applied to operations for extracting monazite from sands could follow the same general pattern of material accounting by technical methods together with guards to check shipments and prevent unauthorized removal.

The guarding and patrolling at monazite sand deposits would be relatively more important than in the case of most uranium occurrences.

SUMMARY

Effective control of the raw material and concentrates of thorium is possible through a system of inspection similar to that found adequate for uranium.

Chapter 3.

Safeguards Necessary to Detect and Prevent the Diversion of Uranium and Thorium from Declared Refineries and Chemical and Metallurgical Plants.

INTRODUCTION.

In connection with the problem of safeguards at refineries and chemical and metallurgical plants, the report of the Scientific and Technical Committee states: "Only the application of very close and careful safeguards would provide an adequate assurance against the diversion from those plants of purified chemical compounds of natural uranium or thorium for the surreptitious production of explosive material for atomic weapons."

FINDINGS.

1. *Total diversion to be dangerous would still be measured in terms of tons, but, because of the greater purity of the materials involved, the quantities concerned would be smaller than in the mining and milling stages.*

2. *An adequate system of inspection of uranium refineries and chemical and metallurgical plants could follow the normal patterns ordinarily used in the control of similar industrial operations.*

As in the case of mines, a system of guards should be provided to control egress from the plant and to check the content and destination of shipments.

Methods of assay and measurement as a basis of accounting have been so developed that at some refineries and chemical and metallurgical plants the uncertainty (technically, the "probable error") on the balance sheet assessed over a period of about a year can be kept by good management to about one percent of the material entering the plant. It is possible in such plants to make a material balance with this accuracy at any time by a clean-up of the material undergoing processing. This naturally interrupts operations, but could reasonably be required at regular intervals and in addition whenever the suspicion of diversion arises. Without a clean-up the uncertainty in the balance over periods of about a month may be several times as great and may vary widely.

Facilities for independent assay and analysis would be part of any inspection system. These might take the form of a central laboratory serving a large number of different plants.

3. *An adequate system of inspection could be so organized as not to interfere seriously with normal refining and chemical and metallurgical operations.*

As in the case of mines, this kind of inspection is not a new problem but one that has been met and solved in commercial practice.

It is a matter of common practice for the management to shut the plant down at intervals and clean the material out of the various stages of the process. This enables a more accurate accounting to be made of the flow of materials through the plant.

An additional safeguard, applicable only to refineries treating the ore concentrates, is a cross-check by comparison of the uranium balance with the balance of radium.

4. *The inspectorate must have unrestricted access to all equipment and all phases of the operations and have facilities for independent weighing, assay and analysis. It must also have the right to require the plant to be shut down for purposes of clean-up and accounting at appropriate times, and also to require efficient operating procedure, assuming to this extent a supervisory character.*

5. *The number of guards and inspectors required would not be great as compared with the operating staff.*

The duties of the inspectors would require varying degrees of technical skill and could not be regarded as purely police functions.

A person could be regarded as qualified to serve as the head of the inspectorate of a refinery, chemical or metallurgical plant if, in addition to having a suitable professional degree and experience, he were given a few months of special instruction.

6. *The comparison of weights and analysis of the shipped material when leaving refineries or chemical and metallurgical plants and on arrival at destination would provide a necessary check on possible diversion in transit.*

Such checks are normally carried out in dealing with chemicals and would be all the more important in the case of pure uranium metal or compounds.

SUMMARY.

Adequate safeguards against diversion from declared refineries and chemical and metallurgical plants are possible by a system of inspection, including guards, similar to normal managerial operating controls, provided that the inspectorate has unrestricted access to all equipment and operations and has facilities for independent weighing, assay, and analysis and provided that it has the right to require the plant to be shut down for purposes of clean-up and accounting at appropriate times and to require efficient operating procedure.

At these stages, there is no fundamental difference between the processes for thorium and for uranium.

Chapter 4.

Safeguards Necessary to Detect and Prevent the Diversion of Uranium from Declared Isotope Separation Plants.

INTRODUCTION.

The separation of U-235 from natural uranium and the enrichment of the U-235 content of natural uranium may play an important part in the peaceful use of atomic energy.

Although it is possible that many different processes may be devised for the separation of the isotope U-235 from naturally occurring uranium, existing plants fall into two main groups:

(a) Electromagnetic separation plants.

(b) Plants based on diffusion processes.

Isotope separation plants may increase the concentration of U-235 in uranium in varying degrees including that necessary for direct use in an atomic weapon. The necessity for adequate safeguards against diversion presents itself therefore, in these plants, in an acute form.

In this connection, the report of the Scientific and Technical Committee states: "Production of nuclear fuels is the crucial stage in the operations...Separation plants for the production of uranium enriched in U-235...deliver nuclear fuel which, under proper conditions, may be used directly for the manufacture of atomic weapons... If, therefore, the strictest safeguards are not taken to prevent the material in the installations producing nuclear fuel from being diverted, the danger is extremely serious."

FINDINGS.

1. *Present electromagnetic and diffusion separation plants have in common the following features which are of importance in determining the necessary safeguards:*

(a) *The complexity and large extent of plants capable of separating significant quantities of U-235.*

(b) *The large amount of material at any time in various stages of concentration in the plants.*

(c) *The difficulty, under the presently available methods of measurement and with present processes, of any strict accounting of U-235 between the input and output materials.*

(d) *The large staff required to operate the plants.*

(e) *The absence from the plants of the radiation hazards which provide natural safeguards in certain phases of the operation of reactors.*

2. *The nature of the plants and the kind of processes to which the material is subjected do not preclude the application of adequate safeguards.*

3. *The necessary close supervision of the processes and the necessary security measures could only be provided by managerial operation by the international control agency of the whole plant.*

SUMMARY.

At present, it is not possible to place reliance on the method of obtaining a material balance of uranium isotopes in the case of isotope separation plants. This is one of the important reasons why there must be internal control of such plants by a director or manager and why the management must be established by and responsible to the international control agency. Even if the material balance could be greatly improved, the inherent danger of the operation would still require management by the international control agency.

Chapter 5.

Safeguards Necessary to Detect and Prevent the Diversion of Uranium, Thorium, and Plutonium from Declared Nuclear Reactors and Associated Chemical Extraction Plants.

INTRODUCTION.

Reactors may vary greatly in size and design. Present reactors include the large units at Hanford, designed for the production of plutonium from natural uranium, and small reactors for research purposes. Other reactors may be designed primarily for the production of power but may produce nuclear fuel as well.

The chemical plants associated with reactors are for the extraction of the fissionable and radioactive materials produced in the reactors and therefore they introduce the problem of safeguards against the diversion of materials which, even in relatively small quantities, could be used for the immediate manufacture of atomic weapons.

In this connection, the report of the Scientific and Technical Committee states: "Production of nuclear fuels is the crucial stage in the operations...The reactors and extraction plants for the production of plutonium or U-233 deliver nuclear fuel which, under proper conditions, may be used directly for the manufacture of atomic weapons... If, therefore, the strictest safeguards are not taken to prevent the material in the installations producing nuclear fuel from being diverted, the danger is extremely serious."

Available information indicates that the utilization of U-233 as nuclear fuel, which can be made from thorium by neutron absorption, though less thoroughly explored than that of plutonium, is theoretically possible. It is believed that safeguards similar to those for uranium and plutonium would be required for thorium and U-233.

Some types of secondary reactors use feed material which is so enriched that it must be very closely safeguarded. Except in this respect, primary and secondary reactors which produce nuclear fuel present similar control problems.

FINDINGS.

1. *The preparation of natural uranium in an appropriate form for insertion in reactors requires safeguards similar essentially to those for the preceding chemical and metallurgical plants.*

2. *The international control agency must ensure that no uranium or thorium is surreptitiously placed in or around the reactor.*

Uranium or thorium surreptitiously placed in or around the reactor would absorb excess neutrons and thus generate nuclear fuels which might escape detection.

3. *The injurious radiations from fission products provide a natural assistance to safeguarding against diversion of slugs from the time they are exposed to the neutrons in a working reactor until the radioactive fission products are removed in the chemical extraction plant.*

Unless they were transported in containers of conspicuous weight and bulk, slugs which have been in the reactor for any length of time would emit radiations which would be both easy to detect and likely to be fatal to those attempting diversion.

4. *The international control agency should supervise the design of the reactors and their associated chemical extraction plants to the extent necessary to preclude features that would make safeguards against diversion difficult. It should also see that construction proceeds according to design.*

It is possible otherwise that devices might be put in place during the construction of the reactor or plant through which slugs might be withdrawn with comparative safety.

5. *The international control agency should continuously obtain all relevant information on the operation of the reactor by observation and measurement.*

This information should include data on the reactor's characteristics and performance, in order that estimates can be made of the amount of plutonium produced and in order that misuse of the reactor can be detected.

6. *The diversion of nuclear fuel during the purification process would be extremely grave and might be very difficult to detect.*

Diversion becomes easier as concentration is completed and purification proceeds because both the bulk and radioactivity of the material are decreased, making detection more difficult and diminishing the hazard to those engaged in illicit work.

7. *As now in operation, the extraction procedure is such that the diversion of purified nuclear fuel might be camouflaged as normal operation losses.*

The amount of nuclear fuel in the slugs cannot be accurately determined to begin with, and the losses during chemical treatment introduce further uncertainties. The task of control would be facilitated if in the future methods for establishing an accurate balance sheet could be developed.

8. *Diversion of purified nuclear fuel is difficult to detect. Assurance against such diversion, therefore, requires that the international control agency itself carry out the functions of management in the case of chemical extraction plants.*

9. *The international control agency must establish the strictest possible safeguards against diversion of highly enriched or pure nuclear fuel during processing, storage, and shipment.*

The nuclear fuel in these conditions is in its ultimate form and can be put to use in an atomic weapon within a few days.

10. *From the nature of things, it is not possible at the present moment to decide in a general way the type of control which will offer adequate safeguards against diversion from reactors, but, in many cases, management by the international control agency may be the only adequate safeguard. Secondary power reactors may be fully as dangerous as primary reactors of equivalent capacity, since either may be used to produce nuclear fuel.*

11. *Satisfactory safeguards in the case of small reactors for research purposes and their associated chemical plants could be provided by a system of licensing and periodic inspection by the international control agency.*

Small reactors for research purposes are those not capable of producing nuclear fuel at a rate significant for military purposes. More stringent safeguards might be required where a number of such reactors with a large total content of nuclear fuel or a large potential production exist in any country, or territories under the same national jurisdiction, since a number of these reactors in combination may be fully as dangerous as a large reactor.

SUMMARY.

A. At present, it is not possible to place reliance on the method of obtaining a material balance of plutonium in the case of reactors and associated chemical extraction plants. This is one of the important reasons why the chemical extraction plants and, in some cases, the reactors should be subject to internal control by a director or manager and why the management must be established by and be responsible to the international control agency. Even if the material balance could be greatly improved, the inherent danger of the operations would still require management by the international control agency.

B. The safeguards required for the control of reactors will depend on their size and design and especially on their content and possible rate of production of nuclear fuel. The safeguards available to the international control agency should include licensing and inspection, supervision, and management of the operation of reactors. In addition, close supervision of the design and construction of reactors is essential in all cases.

C. Periodic inspection together with licensing is an adequate safeguard in the case of small research reactors and their associated chemical plants, unless their total content of nuclear fuel or potential rate of output in any area is of military significance.

D. Adequate safeguards for chemical extraction plants associated with all except small research reactors are only possible through management by the international control agency.

E. Adequate safeguards during the preparation of high-grade or pure nuclear fuels in a suitable form for insertion in secondary reactors, and, during the storage and shipment of such fuels, are only possible through management by the international control agency.

Chapter 6.

Safeguards Necessary to Ensure the Detection of Clandestine Activities.

INTRODUCTION.

Like all problems in atomic energy, the detection of clandestine operations is greatly simplified by the technical facts of the field. Nevertheless, general and political considerations play a larger part in the effectiveness and acceptability of any system for the detection of clandestine oprations than in most other parts of the problem. Thus, any form of general inspection by an international control agency raises problems which are beyond the scope of this present enquiry. They will need most careful consideration when the functions, powers, and organization of the agency are defined. It will be here that the conflicts between the requirements of the international control agency on the one hand and considerations of national sovereignty and present practice on the other will have to be resolved. Throughout this chapter of the report, we shall not always state, but shall always assume, that adequate restraints have been provided against the abuse by the international control agency of the wide powers which it must necessarily be given and that it will conduct its activities in conformity with the established regulations.

Measures for the detection of clandestine operations in the realm of atomic energy must be based on information from a variety of sources co-ordinated and evaluated by a central agency. The control of declared activities will itself provide much useful information. This information, combined with geological data, aerial and ground surveys, (see note of Professor Alexandrov in Finding 5), and periodic reports on specified subjects, will aid in directing attention to areas and operations which might be involved in clandestine activities.

It is essential that, within properly defined limits, the international control agency be granted freedom of travel, the right of access for inspection, and the right to conduct aerial or ground surveys, if there is to be assurance that clandestine activities on a significant scale will be found. Reasonable and proper use of these rights is necessary to avoid undue interference with activities unrelated to atomic energy, and appropriate restraints are necessary. Even so, it seems inevitable that any system of inspection adequate to ensure the detection of clandestine activities will result in knowledge and inspection of activities unrelated to atomic energy. Particular restraints should therefore be provided against the misuse or disclosure of information secured by the international control agency in the course of its activities.

It appears impracticable and undesirable to attempt the routine inspection of the total industrial operations of a nation in order to detect possible clandestine activities in the realm of atomic energy. Consequently, the problem of detecting clandestine operations at stages subsequent to mining and milling involves, first, the establisl ment of reasonable grounds for suspecting clandestine operations in a particular plant or area, and, second, the direct inspection of buildings and installations to the extent necessary to resolve reasonable doubts. Stringent safeguards against clandestine mining and milling operations, together with strict control against diversion from authorized activities at all stages, will reduce the necessity for extensive inspection of ordinary manufacturing and processing installations, in which interference would be most irksome.

FINDINGS.

1. *The right of authorized personnel of the international control agency to direct access and inspection, subject to appropriate restraints, and the right to travel without restraint, is essential in the detection of clandestine activities.*

Direct inspection is the most reliable means of detecting clandestine activities; hence, the right of inspection wherever suspicion exists constitutes an important safeguard. It would in general be necessary to require that demonstrable grounds for suspicion exist as a justification for inspection and to establish reasonable legal procedures for the regulation of inspection. The procedures must not delay legitimate access by the international control agency. However, there are activities and installations which are so closely linked to atomic energy activities or so readily converted to such activities that their existence per se is cause for suspicion and justification for inspection. This includes all mining operations in areas known or likely to contain uranium or thorium in significant amounts. It includes chemical or metalurgical plants processing concentrates which contain even small proportions of uranium or thorium. It includes also certain types of industrial installations, and these should be specified.

2. *The character and scale of operations using known processes for the production of significant quantities of nuclear fuels provide useful indications of their existence.*

Some of the signposts which point to the existence of these operations are:

(a) Mining operations must be substantial.

(b) Large or characteristic installations are required in the case of isotope separation plants, primary reactors, and chemical extraction plants.

(c) Large amounts of power are required for isotope separation plants.

(d) Large quantities of fresh water are required, principally as a cooling medium, in the case of certain reactors. Consequently, such plants are likely to be located on rivers or lakes.

(e) In the case of reactors and associated chemical extraction plants, radioactive wastes are produced.

(f) Extensive shielding against radiation is required in the case of reactors and associated chemical extraction plants.

The above signposts apply to present types of plants. Rapid technical developments and changes in processes are to be expected, but there is no technological basis for expecting that developments of the next several years will permit the use of installations which are not large enough relative to other industrial installations to attract attention. The importance of this consideration lies in the fact that the size of the installations is the best guarantee that their existence in suspected areas could be detected by aerial surveys. It might be possible to subdivide certain operations in an effort to escape detection, but this would entail an increased number of installations.

3. *The international control agency would need periodic reports from States on caegories of information directly related to the production and use of atomic energy. Certain ancillary information would also be desirable.*

Categories of information on which States should submit reports include:

(a) Geological formations in which uranium and thorium might occur.

(b) Mining operations large enough to be potential sources of uranium or thorium.

(c) Production, shipments, location, and use of specialized equipment and supplies such as:

Mass spectrometers,

Diffusion barriers,

Gas centrifuges,

Electromagnetic isotope separation units,
Very pure graphite in large amounts,
Heavy water, and
Beryllium or beryllium compounds in large amounts.

Categories of information which would be desirable include:

(a) Large engineering construction.

(b) Large producers or consumers of heat or electricity.

4. *The international control agency should co-ordinate the available information and thereby determine what areas and installations require further inspection to resolve reasonable doubt that they contain clandestine activities.*

Information of value in the detection of clandestine activities will become available to the international control agency in the course of its control of declared activities.

Information about activities in specific areas could be secured by an appropriate combination of aerial and ground surveys (discussed in Finding 5)

General information related to the production and use of atomic energy could be provided by a system of periodic reports from all national governments (discussed in Finding 3).

Although no one of these types of information alone provides complete assurance that clandestine activities would be detected, the correlation of such information provides a guide to areas and activities requiring direct inspection for clandestine operations.

5. *Aerial surveys combined with ground surveys and direct inspection are essential in some circumstances for the detection of clandestine operations.*

Aerial surveys are essential in some circumstances to the detection of clandestine operations in areas difficult of access or sparsely populated. The international control agency must therefore be granted the right, under appropriate limitations, to conduct such surveys. In some cases, it will be necessary for the agency to have the permanent right to conduct periodic aerial surveys over areas where uranium and thorium ores are known, or likely, to be found. Air surveys should also be authorized in other cases where grounds for suspicion of clandestine operations are shown in accordance with the procedural requirements referred to in Finding 1.

As a source of information, aerial photograph provides a record that is factual, objective, definite, and permanent. Moreover, aerial surveys reduce the time and cost of securing information, especially in examining large areas for unreported mining activities.

> (*NOTE: During the course of the discussion of the proposals concerning the detection of clandestine activity by means of aerial photography and ground surveys, Professor Alexandrov (USSR) stated that the proposals under discussion did, to a great extent, touch more on economic and other spheres not related to atomic energy than on the question of the detection of clandestine activity in the mining and refining of uranium and thorium ores. On this basis, Professor Alexandrov declined to participate in the discussion of those sections of the document dealing with this type of detection.*)

Aerial surveys constitute one source of information about geological formations. The completeness of this information varies with the character of the terrain but must ordinarily be supplemented by ground surveys. Aerial surveys have been used successfully to locate areas in which the occurrence of uranium ores appeared probable, and was later confirmed by ground exploration.

Periodic aerial surveys of areas known, or likely, to contain uranium or thorium ores can readily discover the existence of mining operations. Ground inspection would be required to determine the products of the mines.

Aerial surveys are particularly useful for determining the existence or non-existence of industrial installations in an area in which clandestine activities are suspected. The interpretation of aerial photographs of highly industrialized areas is more difficult than in the case of non-industrial areas, but may be a fairly reliable guide in either case. Aerial photographs give considerable information about the general character of the operations conducted in an installation: power requirements; water requirements; and the flow of raw materials and products. However, direct ground inspection is necessary to determine accurately the character of the operations.

New installations, or extensive modifications in existing installations, are readily detectable by comparison of aerial photographs at successive intervals.

Camouflage is not very effective against photographic aerial survey but makes it difficult to determine the nature of the installations under observation.

6. *Ground surveys are a useful means for the detection of clandestine operations; under certain conditions, the right to conduct such surveys is essential.*

The principal objectives of ground surveys would be to locate mines and large industrial buildings, to conduct geologic surveys, to make physical measurements useful in locating clandestine activities (such as seismic measurements to detect blasting), and to sample materials for radioactive elements.

In crowded, built-up areas, ground surveys will ordinarily provide a satisfactory and reasonably convenient means for determining the existence or non-existence of operations which warrant direct inspection. Generally speaking, investigation by ground parties would be likely to pick up less irrelevant information than investigation by aerial surveys. Moreover, certain types of installations cannot be investigated adequately from the air. Examples range from underground structures and installations located in densely wooded areas to ordinary industrial buildings which may be detected with ease, but without reliable indication of the activities involved. Direct inspection may not be required if ground investigation discloses no basis for suspicion.

Ground surveys can be conducted with maximum efficiency if aerial surveys are available as an indication of the areas and installations which warrant attention, as well as the areas which can be ignored without appreciable risk.

The right to conduct ground surveys is essential, but should be subject to appropriate restrictions similar to those required for inspection.

7. *Safeguards against the dangers of clandestine mining would be provided by the right of inspection coupled with air and ground surveys based on adequate geological knowledge. Neither air survey nor ground survey alone provides adequate information; both are essential and they must be used in combination.*

All available geological knowledge, whether acquired directly or indirectly, is needed by the international control agency to determine the areas to which air and ground surveys should be directed for the detection of possible clandestine mining and milling. Aerial surveys of such areas, which should be provided for in accordance with Finding 5, will ordinarily reveal any unreported operation, or changes in a known installation, but will not usually indicate the character of the operations. Ground surveys may be required in areas not readily evaluated by aerial photography, e.g., heavily wooded areas or caves.

It is assumed that all declared mines producing uranium or thorium would be under controls designed to prevent the diversion of these materials. All other mines would have to be inspected at appropriate intervals to make sure that they did not produce uranium or thorium as by-products, except where the geological formations exclude the possibility of uranium or thorium deposits.

In areas where the occurrence of uranium or thorium is known or probable on the basis of geological information, periodic aerial surveys could provide an adequate check on the existence of unreported mining operations. However, the character of these operations could only be determined by inspection at the mine and sampling of the ore and the products from the mine.

The detection of suspected clandestine mining operations might, on occasion, be facilitated by inspection of transportation facilities and materials being transported to or from areas known, or likely, to contain uranium or thorium deposits. In some cases the means of transportation required for unreported operations located in remote areas would provide an indication of the existence of activity of an unknown character. In cases involving transportation by water or by hydroplane, the usefulness of this method of detecting possible clandestine activities may be quite limited.

8. *Clandestine refineries and chemical and metallurgical plants may not differ from conventional chemical processing plants to a degree which would aid in their detection.*

Plants for the chemical and metallurgical treatment of uranium and thorium concentrates need not be so large as to attract attention. While the existence of these plants probably could be detected by

aerial surveys if they were conducted, there would be little to indicate that they were engaged in clandestine operations. However, these plants alone would not constitute a serious threat, since their product would have to be fed into isotope separation plants or reactors which do have distinguishing characteristics.

9. *The detection of clandestine bomb manufacture as such is almost impossible; it is therefore vital that any unauthorized accumulation of essential nuclear fuels be prevented.*

Plant installations for the manufacture of bombs are small compared with those required for the production of nuclear fuels, and they have no distinguishing features to facilitate detection. As long as bomb design requires an unusual quality and variety of research personnel, the activities of such personnel might indicate where bombs were being produced clandestinely; however, once the design of atomic weapons had been developed, the need for scientific personnel would be reduced and the value of a knowledge of the activities of key personnel would therefore be slight. Because of the difficulties in detecting clandestine bomb manufacture and because of the extremely short time and small facilities required to produce the bomb if the necessary nuclear fuel is available, it is essential that stringent safeguards be taken at earlier stages. Accordingly, the prevention of clandestine bomb manufacture must begin with the establishment of safeguards against diversion and clandestine production of raw materials and must be applied at all stages in the production and use of fissionable material.

SUMMARY.

A. The international control agency will require broad privileges of movement and inspection, including the rights to conduct surveys by ground and air. These privileges should, however, be very carefully defined to ensure against misuse.

B. Reports and returns on relevant matters will be required from national governments.

C. The international control agency should co-ordinate all relevant information to determine what areas may be suspected of containing clandestine activities.

D. Isotope separation plants, reactors, and chemical extraction plants, as well as mines, have distinguishing features which would facilitate the detection of clandestine activities at those stages.

E. Detection of clandestine refineries and chemical and metallurgical plants is more difficult than detection of clandestine operations at other stages in the processing of nuclear fuel.

F. The detection of clandestine bomb manufacture as such is almost impossible; it is therefore vital that any unauthorized accumulation of essential nuclear fuels be prevented.

Chapter 7.

Safeguards Against the Seizure of Atomic Energy Establishments or Materials.

Seizure means the overt removal of declared peaceful activities from the exercise of effective authority by the international control agency. The seriousness of seizure of atomic plants and materials would depend on the stage in the production of nuclear fuels at which seizure occurred. The relative dangers of the material at various stages have been considered and are set forth in the earlier findings. The problem of erecting safeguards against the dangers from seizure is before the Commission, but has not yet been given more than preliminary consideration. However, it is possible at this time to indicate the scope of the problem and some of the considerations involved.

The agreed finding of the Scientific and Technical Committee in this connection, as stated in its report, is: "We have been discussing the possibilities of clandestine diversion of materials from the peaceful activities in the domain of atomic energy, but we must not overlook that with certain systems of control one would have to consider the possibility that plants or materials might be seized. This implies a danger, the seriousness of which would be greatest in the case of seizure of stocks of concentrated nuclear fuel, because from that stage weapons could be produced most quickly and in relatively small plants. Next in order of seriousness would be the seizure of plants producing nuclear fuels. A wide geographical dispersal of stocks and plants and the restriction of stocks to minimum operating levels would reduce the risk that a large quantity would be involved in a single seizure. Seizure of mines or of facilities at other early stages would only be of advantage to those desiring to make weapons if they had at their disposal a plant capable of producing nuclear fuel."

Political and general considerations are paramount in the matter of safeguards against seizure. No technical measures are likely to prevent seizure by a nation that has determined upon aggression and such measures as could be administered by an international control agency could hardly give complete satisfaction from the point of view of safety. There may, however, be some measures of a technical nature which could be applied through an international control agency; these measures would assist in forestalling seizure and would tend to minimize the military advantages that an aggressor could expect from seizure.

The nature of the evidence reviewed by the Commission to date suggests that its further deliberations on the subject of seizure should include consideration of the following topics:

1. Seizure as it applies to materials and plants under different types of safeguards.
2. The desirability of the geographical dispersal of plants and stocks of materials.
3. The possibility of the reduction of inventories of materials in process or in storage.
4. The possibility of making the materials for power unsuitable for weapons.
5. The desirability of, providing for the damaging or destruction of plants before they can be seized.

SUMMARY.

Problems relating to seizure have been considered thus far only in preliminary terms. The major questions of seizure are political rather than technical. It appears, however, that technical measures could reduce the military advantages and therefore the dangers of seizure.

Chapter 8.

Co-ordination of Safeguards.

INTRODUCTION.

The preceding chapters of this report have discussed the safeguards required at each stage in the production and use of atomic energy to prevent the dangers indicated in the report of the Scientific and Technical Committee. In designing an effective and comprehensive system of control, attention must be given not only to the safeguards required at the several stages but also to the interrelation among those safeguards. Of particular importance in this connection is the scheduling of operations at successive stages in such a way that stocks of dangerous material are kept to a minimum.

The co-ordination of safeguards raises further important questions as to the nature, organization, and powers of the international control agency responsible for the control of atomic energy. Preliminary investigations have indicated that, when considering the powers of the international control agency, further attention will have to be given to the interrelations among controls at various plants and the degree of control over uranium and thorium through all of the processes. These subjects have not as yet been considered by the Committee.

FINDINGS.

1. *In addition to material accounting at each individual step in atomic energy processes, the international control agency should provide for material accounting checks between points of shipment and receipt of material as a means of detecting possible diversion in transit.*

2. *The international control agency should control the storage and shipment of uranium and thorium materials to the degree necessary for security purposes.*

3. *The international control agency should itself store and itself handle all enriched or pure nuclear fuel in transit. This does not necessarily imply ownership either of the materials or of the transit or storage facilities, questions which have not yet been discussed.*

4. *Since stocks of concentrated or pure nuclear fuel are acutely dangerous, operations at successive stages in the production of atomic energy should be so scheduled that stocks of materials in transit and in storage are minimized, but without interfering unduly with the development and effectiveness of peaceful activities.*

List of Manhattan Project Declassified Documents-II

Below we continue a listing of titles of declassified documents from the Manhattan Project. The titles below are of documents declassified during the period August 1st to December 1st. These titles, a continuation of the group contained in Part A of the list in our last issue, essentially brings this group of titles up to date.

Spherical Proportional Counter—H. Agnew.

Boron Cross-Section for Neutrons from 0.01 to 1000 Ev—E. E. Anderson, L. S. Lavatelli, B. D. McDaniel, R. B. Sutton.

The Preparation of Sodium Trifluoroacetate and Ethyl Trifluoroacetate—J. H. Babcock, C. I. Gochenour, A. D. Kischitz.

Research Program—Biology and Medicine—A. M. Brues.

Some Remarks on the Hydrodynamical Theory of Wave Propagation with an Application to a Problem in the Flow of Metals Incompressible at Low Pressures—J. W. Calkin.

Preparation and Properties of Sulfides and Oxide-Sulfides of Uranium—E. D. Eastman, L. Brewer, L. A. Bromley, P. W. Gilles, N. L. Lofgren.

Process Monitor, Mark 10, Model 20—W. P. Jesse.

The Complete Analysis of Fluorine Gas—R. H. Kimball, L. E. Tufts.

The Determination of Fluorine and Chlorine in Organic Compounds—R. H. Kimball, L. E. Tufts.

A Mass Spectrometer for Routine Hydrogen Isotope Analysis—A. O. Nier, M. G. Inghram, C. Stevens, B. Rustad.

A Null Method for the Comparison of Two Ion Currents in a Mass Spectrometer—A. O. Nier, E. P. Ney, M. G. Inghram.

Fluorine and Fluorocarbon Chemistry—G. W. Russell.

Orbits of Particles in the Racetrack—R. Serber.

Gold Cross Section for Neutrons from 0.01 to 0.3 Ev—E. E. Anderson, L. S. Lavatelli, B. D. McDaniel, R. B. Sutton.

Parallel-Plate Alpha Counting System, Mark 6, Model 30A—Author unknown.

The Titrimetric Determination of Thorium—C. V. Banks, H. Diehl.

Characteristics of Some Commercial Photomultiplier Tubes Under Pulse Conditions—H. S. Bridge.

Neutron Diffusion—Spherical Harmonics Theory—B. Carlson.

Energy of the Hard Gamma Rays of La^{140}—M. Deutsch.

Note on a Use of Delay Lines in Counter Pulse Amplifiers—O. R. Frisch.

Calibration of Cadmium-Covered Gold Foils in a Graphite Block—E. D. Klema.

Tolerance Concentrations of Radioactive Substances—K. Z. Morgan.

The Transport Cross Section of Helium for Fast Neutrons—P. Olum, V. F. Weisskopf.

Instrumentation of the Hanford Engineer Works—W. P. Overbeck.

High-Efficiency Neutron Counter for Fast Coincidence Measurements—T. M. Snyder.

Estimation of Small Quantities of Uranium in Thorium—S. I. Weissman, R. B. Duffield.

Alpha Chamber Modified—J. E. Willard.

Revised Alpha Chamber—J. E. Willard.

General Rules and Procedures Concerning Activity Hazards—J. E. Wirth.

Characteristics of Metal Type Electron-Multiplier Tube—J. S. Allen.

The Range of Deuterons in Heavy Water and of Protons in Hydrogen—J. Ashkin.

Distribution Arising from a Point Source of Fast Neutrons Between Two Slowing-Down Media—R. Bellman, R. E. Marshak.

Fluorination of Normal Heptane—R. G. Benner, A. F. Benning, F. B. Downing, K. C. Johnson, H. M. Parmelee.

Chemical and Spectrochemical Analysis of Uranium and Plutonium Materials—H. E. Boaz, P. Numerof, H. A. Potratz, W. H. Throckmorton.

The Formation of Uranium Hydride—J. E. Burke.

A Metastable State of 22 Micro-seconds in Ta^{181}—S. De Benedetti, F. K. McGowan.

Investigation of Proportional Counters—B. C. Diven, B. Rossi.

Electrolytic Cells for Production of Fluorine—R. C. Downing, et al.

Long Range Alpha Particles Emitted in Connection with Fission—Preliminary Report—G. Farwell, E. Segre, C. Wiegand.

Angular Distribution of Scattering of 30-Kev Neutrons—D. H. Frisch.

Capture Cross Section of Gold as a Function of Neutron Energy—K. I. Greisen.

Theory of Multiplicaptive Processes—I.—D. Hawkins, S. Ulam.

Taylor's Hydrodynamics of Strong Shocks Applied to Gases Having Small Values of Gamma—I.—J. Hirschfelder.

The Role of Instruments in the Atomic Project—W. P. Jesse.

Solubility of Argon in Uranium—I. B. Johns.

Studies of Adjustments of a Zinn-Type Ion Source—T. Jorgensen, Jr.

Preliminary Determination of the Neutron Absorption Cross Section of Long-Lived I^{129}—S. Katcoff.

Sweeping of Radio-active Gases from a Homogeneous Pile—S. Katcoff.

The Determination of the Oxygen Content of Metals by the Carbon Monoxide Method—D. Lipkin, M. L. Perlman.

Some Neutron Diffusion Problems—R.E. Marshak.

Hot Wire Reduction of Metals—C. R. Maxwell.

Preparation of Boron by Reduction of BCl_3 with H_2—C. R. Maxwell.

Studies in Complex Formation. I. The Extraction of Ferric Chloride by Isopropyl Ether—N. H. Nachtrieb, J. G. Conway.

Fast-Neutron Distribution: Two infinite Plane Slowing-Down Media with Point Source in One Medium—E. Ostrow.

Fluorination of Hexafluoroxylene—H. M. Parmelee, et al.

Range of U^{235} Fission Fragments in Photographic Emulsion—H. T. Richards.

The Production of Slow Neutrons in a Carbon Block—C. Richman, T. Snyder, R. W. Williams.

Model 100 Preamp Circuit: Schematic—M. Sands.

A Modified Procedure for the Quantitative Determination of the Urinary Corroporphyrin Isomers (I and III)—S. Schwartz, S. Cohen, C. J. Watson.

Element 94 in Nature—G. T. Seaborg, M. L. Perlman.

Piling Up of Counts—R. Serber.

Absorption Curve and Energy of 31 sec. 0^{19}-Rays and Cross Sections—L. Seren, W. E. Moyer, W. Sturm.

An Intense Positive Ion Source for Solids—A. E. Shaw.

Tables for Conversion of Atomic Weight and Volume Percentages in Alloys of Heavy Metals—C. S. Smith.

A Spectrographic Method for the Determination of Fluorine—R. W. Spence.

Report on an Investigation of the Behavior of Argon-Hydrogen Mixture and Isobutane in a Spherical Chamber—H. Staub, D. Nicodemus.

(p,n) Reactions in Deuterium, Scandium and Vanadium—R. F. Taschek.

The Analysis and Disposal of Fluorine—S. G. Turnbull, et al.

Turner Vacuum Valve—C. M. Turner.

Photo-Neutron Sources and the Energy of the Photo-Neutrons—A. Wattenberg.

Safety Circuit with DC Amplifier—R. J. Watts.

Fission Products: 25-Minute Samarium 155—L. Winsberg.

Study of Emulsions for Photographing Oscilloscope Screens—N. York.

A Report on Hyperfine Structure in the Arc Spectrum of Enriched Uranium—O. E. Anderson, H. E. White.

The Magnetic Moments of the Neutron and the Deuteron—W. R. Arnold, A. Roberts.

Note on Barium Plutonate (Mono or Poly Plutonate)—R. E. Connick, W. H. McVey.

Note on the Oxidation of Pu (III) by Chlorine—R. E. Connick, W. H. McVey.

Note on the Oxidation of Pu (III) by Nitrate Ion—R. E. Connick, W. H. McVey.

Note on the Oxidation of Pu (III) by Oxygen—R. E. Connick, W. H. McVey.

The +3 Oxidation State of Plutonium—R. E. Connick, W. H. McVey, G. E. Sheline.

Simultaneous Photography of Two Spectral Regions in Chemical Analysis—J. Conway, N. H. Nachtrieb, E. D. Wilson.

Integrating Polonium Meter—T. R. Cuykendall, L. T. Finlayson.

Determination of the Thermal Conductivity of Sodium-Potassium Alloy at Elevated Temperatures—H. Deem, H. W. Russell.

The Complex Ions Formed by Thorium and Iron with Fluoride in Acid Solution—H. W. Dodgen.

Measurement of Weak Neutron Intensities by Szilard-Chalmers Reaction in Calcium Permanganate Solution—R. W. Dodson, M. Goldblatt, J. H. Sullivan.

Spectrochemical Analysis by the Copper Spark Method—M. Fred, N. H. Nachtrieb, F. S. Tomkins.

Differential Pressure Indicator—General Electric Company, Apparatus Division.

Chemical and Physical Properties of Fluorocarbons—A. V. Grosse, C. H. Cady.

Penetration of Gamma Rays Through Thick Layers—M. H. Hull.

Properties of 94-239—J. W. Kennedy, G. T. Seaborg, E. Segre, A. C. Wahl.

Snouting and Focusing the Cyclotron Beam—L. S. Lavatelli.

Inorganic Separations Using Ion Exchange—G. P. Monet.

The Self Diffusion Coefficient of Uranium Hexafluoride—E. P. Ney, F. C. Armistead.

Evaluation of Scattering Data—P. Olum.

Contributions to the Radiochemistry of 104 Day Y^{88}—R. T. Overman.

Properties and Measurement of C^{14}—A. F. Reid, A. S. Weil, J. R. Dunning.

Determination of Oxygen by the Vacuum Fusion Method—C. N. Rice.

Tension and Compression Tests of Pure Bismuth—A. U. Seybolt.

An Attempt to Observe the Radioactivity of the Neutron—E. F. Shrader, D. Saxon, A. H. Snell.

The Scattering of Slow Neutrons by Ortho and Parahydrogen—R. Sutton, et al.

Radioactive Threshold Detectors for Neutrons—R. F. Taschek.

Long Electrostatic Generator Improvements—C. M. Turner.

Neutron Absorption Method for Boron Analysis—R. Walker.

Elementary Pile Theory—S. K. Allison.

Thermocouple-Type Hot-Wire Flowmeter—J. W. Anderson, S. E. Bakes, I. B. Johns.

Calculations on Counter-current Electro-Migration—G. Breit, F. L. Friedman.

Confirmation of Assignment of 2.6 h Ni to a Mass Number of 65—E. E. Conn, A. R. Brosi, J. A. Swartout.

Intensity Fluctuations of a Neutron Chain Reactor—F. de Hoffmann.

Theory of the Criticality of the Water Boiler and the Determination of the Number of Delayed Neutrons—F. de Hoffmann.

The Preparation of Thin Boron Films—R. W. Dodson, H. Russell, Jr.

Measurement of Neutron Fluxes in the Region 30 to 500 Kev with Proportional Counters—D. H. Frisch.

Isotopic Assignment of Cd and Ag Activities—A. C. Helmholz.

The Counting Method of Isotopic Analysis of Uranium (Parts I and II)—D. E. Hull.

A Manual on the Measurement of Radioactivity—A. H. Jaffey, T. P. Kohman, J. A. Crawford.

Preparation of a Compact Radioyttrium Gamma-Ray Source—M. Kahn.

The Preparation of Thin Films of Thorium Oxide—M. Kahn.

Oxidation of Tracer Amounts of Plutonium by Perchloric Acid—M. Kahn.

Ionic Equilibria and Reaction Kinetics of Plutonium in Hydrochloric Acid Solutions—M. Kasha, G. E. Sheline.

Radiocolloidal Behavior of Neptunium and Plutonium. Absorption of Plutonium (IV) at tracer concentration onto glass—E. L. King.

The Fission Cross Section of Np^{237}—E. D. Klema.

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Letters to the Editor

ERRATUM:

We are indebted to Dr. Manson Benedict for calling our attention to a serious misprint in the last issue of the Bulletin. The authors of the important Report entitled "Technological Control of Atomic Energy Activities" are: M. Benedict (chairman), L. W. Alvarez, R. F. Bacher, L. A. Bliss, S. G. English, A. B. Kinzel, P. Morrison, J. R. Ruhoff, F. H. Spedding, C. Starr, and W. J. Williams.

We inadvertently omitted the names of R. F. Bacher, J. R. Ruhoff, and F. H. Spedding.

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the sacrifice of America's right to veto majority decisions directed against herself, now clamors that the abolition of the veto is the only security the Baruch plan gives to us.

The abolition of the veto will give America no additional security beyond that provided by readiness to go to war over a violation of atomic control. On the other hand, retention of the veto will give no security to U.S.S.R. We must not limit our appeal for concessions to one side in this controversy. Rather we must appeal to all sides for willingness to compromise on secondary issues, and for concentration on the real difficulties of the problem, such as the administrative set-up of the control agency, and the equitable distribution of atomic plants. Only resolution to place the prevention of atomic war above all other considerations will permit the successful solution of problems which are among the most difficult that statesmen have ever been called to solve by agreement.

* * *

And so, at the turn of the year, we find ourselves, in the position of a wanderer, who after a steep climb, has reached a point where, turning backwards, he can see the plain from which he had started, and rejoices in having advanced so far; but who, looking forward, sees the dark mountain still towering ahead of him hidden in clouds; and who, having no other choice, prepares to continue the ascent.

E. R.

The opinions expressed in the editorials and other articles in the Bulletin do not necessarily represent the official views of any organization.

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